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Typical Report Citation and Abstract

❶ 19970001126 NASA Langley Research Center, Hampton, VA USA

❷ **Water Tunnel Flow Visualization Study Through Poststall of 12 Novel Planform Shapes**

❸ Gatlin, Gregory M., NASA Langley Research Center, USA Neuhart, Dan H., Lockheed Engineering and Sciences Co., USA;

❹ Mar. 1996; 130p; In English

❺ Contract(s)/Grant(s): RTOP 505-68-70-04

❻ Report No(s): NASA-TM-4663; NAS 1.15:4663; L-17418; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

❼   To determine the flow field characteristics of 12 planform geometries, a flow visualization investigation was conducted in the Langley 16- by 24-Inch Water Tunnel. Concepts studied included flat plate representations of diamond wings, twin bodies, double wings, cutout wing configurations, and serrated forebodies. The off-surface flow patterns were identified by injecting colored dyes from the model surface into the free-stream flow. These dyes generally were injected so that the localized vortical flow patterns were visualized. Photographs were obtained for angles of attack ranging from 10' to 50', and all investigations were conducted at a test section speed of 0.25 ft per sec. Results from the investigation indicate that the formation of strong vortices on highly swept forebodies can improve poststall lift characteristics; however, the asymmetric bursting of these vortices could produce substantial control problems. A wing cutout was found to significantly alter the position of the forebody vortex on the wing by shifting the vortex inboard. Serrated forebodies were found to effectively generate multiple vortices over the configuration. Vortices from 65' swept forebody serrations tended to roll together, while vortices from 40' swept serrations were more effective in generating additional lift caused by their more independent nature.

❽ Author

❾ *Water Tunnel Tests; Flow Visualization; Flow Distribution; Free Flow; Planforms; Wing Profiles; Aerodynamic Configurations*

Key

1. Document ID Number; Corporate Source
2. Title
3. Author(s) and Affiliation(s)
4. Publication Date
5. Contract/Grant Number(s)
6. Report Number(s); Availability and Price Codes
7. Abstract
8. Abstract Author
9. Subject Terms

AERONAUTICAL ENGINEERING

A Continuing Bibliography (Suppl. 376)

JUNE 12, 1998

01
AERONAUTICS

19980041314 Naval Postgraduate School, Monterey, CA USA
Summary of Research 1996, Department of Aeronautics and Astronautics*, 1 Jan. - 31 Dec. 1996*
Nov. 1997; 74p; In English
Report No.(s): AD-A337743; NPS-09-97-003; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
    This report contains summaries of research projects in the Department of Aeronautics and Astronautics. A list of recent publications is also included which consists of conference presentations and publications, books, contributions to books, published journal papers, technical reports, and thesis abstracts.
DTIC
Aeronautics; Astronautics; Research Projects

19980041562 Research Triangle Inst., Research Triangle Park, NC USA
Survey Summary of AGATE Concepts Demonstration at Annual NATA Convention, March 24-26, 1997, Volume 1, Basic Report *Final Report*
Dec. 1997; 58p; In English; Original contains color illustrations
Contract(s)/Grant(s): NAS1-19214; RTOP 538-07-19-01
Report No.(s): NASA/CR-97-201731/Vol-1; NAS 1.26:201731/Vol-1; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
    An AGATE Concepts Demonstration was conducted at the annual National Air Transportation Association (NATA) Convention in 1997. Following a 5-minute introductory briefing, an interactive simulation of a single-pilot, single-engine aircraft was conducted. The participant was able to take off, fly a brief enroute segment, fly a Global Positioning System (GPS) approach and landing, and repeat the approach and landing segment. The participant was provided an advanced "highway-in-the-sky" presentation on both a simulated head-up display and on a large LCD head-down display to follow throughout the flight. A single-lever power control and display concept was also provided for control of the engine throughout the flight. A second head-down, multi-function display in the instrument panel provided a moving map display for navigation purposes and monitoring of the status of the aircraft's systems. An estimated 100 people observed or participated in the demonstration, and 68 surveys were collected. The pilot ratings of the participants ranged from student to Air Transport Rating with an average of 6089 hours total flight time. The overwhelming response was that technologies that simplify piloting tasks are enthusiastically welcomed by pilots of all experience levels. The increase in situation awareness and use of the head-up display were universally accepted and lauded as steps in the right direction.
Author
Flight Simulation; Single Engine Aircraft; Takeoff; Aircraft Landing; Global Positioning System; Approach

19980044381
Time-frequency analysis of jet screech using short time Fourier transform and Wigner-Ville distribution
Ohta, Hiromitsu; Seto, Kunisato; Nippon Kikai Gakkai Ronbunshu, C Hen/Transactions of the Japan Society of Mechanical Engineers, Part C; August, 1997; ISSN 0387-5024; Volume 63, no. 612, pp. 2747-2751; In Japanese; Copyright; Avail: Issuing Activity
    Non-stationary signals must be represented in a time-frequency analysis because such signals vary with time. The purpose of the present study is to analyze a degree of a non-stationary sound such as a jet screech, is a type of shock-associated noise which is induced by the flow. In particular, when the pressure ratio (jet pressure/ambient) is higher than about 3.0 in an underexpanded mode, the non-stationarity of the noise is very strong. In this research, a short time Fourier transform (STFT) and Wigner-Ville

distribution (WD) have been used to analyze a jet screech represented in a time-frequency domain. An attractive feature of the STFT is its superior in frequency precision. On the other hand, WD has superior ability in resolution of a time-frequency. However it sufferes a bad influence of cross terms, which yield spurious peak spectra. Finally, it is shown that the optimum application to analyze of a jet screech is possible by using STFT and WD method collaterally.
Author (EI)
Fourier Transformation; Quantum Mechanics; Screech Tones; Sound Waves; Noise (Sound); Spectrum Analysis; Fast Fourier Transformations; Aerodynamics; Time Series Analysis

19980044551
Inverse airfoil design using the Navier Stokes equations
Eyi, S., Middle East Technical Univ., Turkey; Lee, K. D.; Engineering Optimization; 1997; ISSN 0305-215X; Volume 28, no. 4, pp. 245-262; In English; Copyright; Avail: Issuing Activity
    The feasibility of the use of the Navier-Stokes equations in aerodynamic design is examined. The Navier-Stokes equations can include the rotational viscous physics at transonic speeds, and hence are expected to produce more reliable designs. The target pressure is specified and a least-squares optimization is used to minimize the pressure discrepancy between the target and designed airfoils. The sensitivity analysis which determines the response of the flow to a geometry perturbation is performed based on a finite-difference evaluation. The performance of the design method is evaluated with various design practices.
Author (EI)
Navier-Stokes Equation; Airfoils; Optimization; Aerodynamics; Transonic Flow

19980047452
Fairchild Dornier plans 70-90-seat twinjets
Sparaco, Pierre, USA; Aviation Week & Space Technology; Feb. 16, 1998; ISSN 0005-2175; Volume 14, no. 7, pp. 34; In English; Copyright; Avail: Aeroplus Dispatch
    Fairchild Dornier's plans to create a family of 30-90-seat regional transports and corporate jets and conclude additional risk-sharing partners are briefly reviewed. The plans include an all-new 70-seat twinjet, 728JET, with a 72,500-lb maximum takeoff weight, that would be powered by two 14,000-lb-thrust turbofan engines. Maximum cruise speed would be Mach 0.8, with a range of 1,200 nautical miles. The 728JET and its stretched-fuselage 90-seat derivative, 928JET, are expected to be launched in mid-2001.
AIAA
Aircraft Production; Transport Aircraft; Dornier Aircraft

19980047503
Eurofighter cleared for take-off
Poguntke, Peter, Germany; AeroSpace; Feb. 1998; ISSN 0949-7064, no. 1, pp. 4-7; In English; Copyright; Avail: Aeroplus Dispatch
    An agreement was recently signed between representatives of Germany, UK, Spain, and Italy which paves the way to the European fighter aircraft of the coming century. This was followed by the signing of industrial agreements betwen Netma, the NATO Eurofighter Tornado Management Agency, and the consortia Eurofighter Jagdflug and Eurojet GmbH on production and logistic support for 620 aircraft and around 1500 EJ200 jet engines. The military and economic importance of the Eurofighter project is emphasized.
AIAA
Fighter Aircraft; North Atlantic Treaty Organization (NATO)

19980047630
Civil ALH on horizon
Parker, Ian; Helicopter World; Feb. 1998; ISSN 0262-0448; Volume 17, no. 1, pp. 43, 44; In English; Copyright; Avail: Aeroplus Dispatch
    The flight development of the Advanced Light Helicopter (ALH) by Hindustan Aeronautics Ltd. (HAL) is reported to be nearly complete, with certification expected in December, 1998. This multirole helicopter in the 4.5-5.5 ton category is designed primarily for the Indian armed forces but will be offered to the civil market at a competitive price. It has a hingeless composite main rotor, and its other advanced technology features include an IDS (integrated dynamic system), which consists of the hub,

main transmission, upper control and flight hydraulics, and the four-bladed bearingless tail rotor. The IDS incorporates condition monitoring and fault diagnostics systems, such as magnetic chip detectors (Zapper system), and pressure and temperature sensors. AIAA

Civil Aviation; Helicopters; Helicopter Design; Composite Materials

19980047921

Battle to replace the Deer. II - Hokum versus Havoc

Gordon, Yefim; Komissarov, Dmitri; Defence Helicopter; Mar. 1998; ISSN 0963-116X; Volume 17, no. 1, pp. 43, 44, 46; In English; Copyright; Avail: Aeroplus Dispatch

Although the competition between Ka-50 'Hokum' and Mil-28A 'Havoc' attack helicopters officially ended with the Russian MOD's choosing of the Ka-50 in 1994, both of these designs were daytime-operations configurations. The reconfiguration of sensor and weapons suites of both designs for day/night-capable operations has accordingly been aggressively pursued by both manufacturers with a view to export markets. AIAA

Mil Aircraft; Military Helicopters; Daytime; Aircraft Production; Helicopter Design; Laser Range Finders

19980047923

Will Apache be a good shipmate?

Ripley, Tim; Defence Helicopter; Mar. 1998; ISSN 0963-116X; Volume 17, no. 1, pp. 26-29; In English; Copyright; Avail: Aeroplus Dispatch, FROM

An evaluation is made of the various possible methods that can be economically employed to maximize the suitability of the Apache attack helicopter, and similar helicopters initially designed and manufactured for land operations, for shipboard operations. Attention is given to the 'wet assembly' methods required to prevent salt spray-laden marine atmospheres from penetrating structures through capillary action and corroding Mg-alloy structural components. AIAA

Military Helicopters; Defense Program; Ships; Air to Air Missiles; Antiship Missiles

19980047925

Tiny Prowler takes wing

Svoboda, Jan; Kuzdas, Jiri; Unmanned Vehicles; Apr. 1998; ISSN 1351-3478; Volume 3,, no. 1, pp. 22-24; In English; Copyright; Avail: Aeroplus Dispatch

An account is given of the design features and performance capabilities of the Sojka-III Unmanned Air Vehicle for land battlefield tactical surveillance. The various electrooptic, photographic, etc. payloads are user-defined; range is 60-100 km, and maximum takeoff weight is 150 kg. AIAA

Military Helicopters; Pilotless Aircraft; Ground Stations; Helicopter Performance

19980047927

Going gray

Grier, Peter, Christian Science Monitor, USA; Air Force Magazine; Feb. 1998; ISSN 0730-6784; Volume 81, no. 2, pp. 63-67; In English; Copyright; Avail: Aeroplus Dispatch

A survey is presented of the findings of a National Research Council (NRC) report on aging USAF aircraft and the fatigue cracking and corrosion problems uncovered. The NRC report underscores known problems associated with old aircraft with the imponderables of USAF maintenance manpower cuts, greater use of contract maintenance, and the exacerbation of low-cycle fatigue by the addition of new armaments or flying tactics. AIAA

Service Life; Aircraft Maintenance

19980048218

Study on crowded two-dimensional airspace - Self-organized criticality

Lin, Kuo-Chi, Inst. for Simulation and Training, USA; Sisti, Alex, USAF, Research Lab., USA; Chow, Lee, Central Florida, Univ., USA; Journal of Aircraft; Apr. 1998; ISSN 0021-8669; Volume 35, no. 2, pp. 301-306; In English; Copyright; Avail: Aeroplus Dispatch

A crowded airspace involves large numbers of airplanes interacting with each other. In general, the dynamic behavior of the system is quite complex and conventional mathematical modeling is difficult. Here, a generic air traffic model is used to investigate the application of the notion of self-organized criticality. An example of a crowded two-dimensional airspace near an airport is studied. The results show that a crowded air traffic system exhibits the characteristics of self-organized criticality.
Author (AIAA)
Air Traffic; Aircraft Approach Spacing

02
AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

19980041512 Lockheed Martin Tactical Aircraft Systems, Tactical Aircraft Systems, Fort Worth, TX USA
Analysis of Limit Cycle Oscillation/Transonic High Alpha Flow Visualization *Final Report, 30 Sep. 1994 - 30 Sep. 1997*
Cunningham, Atlee M., Jr., Lockheed Martin Tactical Aircraft Systems, USA; Geurts, Evert G., Lockheed Martin Tactical Aircraft Systems, USA; Dec. 11, 1997; 252p; In English
Contract(s)/Grant(s): F49620-94-C-0093
Report No.(s): AD-A336099; AFRL-SR-BL-TR-98-0060; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche
    A flow visualization test was conducted with the simple straked wing in August, 1996 (at the National Aerospace Laboratory NLR, The Netherlands), for the purpose of obtaining flow visualization data to compliment the pressure and force data base generated in earlier tests of the same configuration. This tests was conducted in two parts to examine the flow field characteristics (1) at high alpha conditions that involve vortices, shocks, and separated flows, and (2) at low alpha condition typical of transonic LCO flows with and without tip stores. Laser light sheet/water vapor techniques were used to illuminate the flows, and video recording was used to obtain the data. Both low and high speed video cameras were used to examine spanwise and streamwise laser sheet positions. In addition, under NLR funding, some preliminary particle image velocimetry (PIV) data were obtained at M = 0.225 and 0.6, as well as some pulsed laser flow visualization (9 nano-sec pulse) at M = 0.9. Correlation was performed between the flow visualization data from this test and the pressure/force data obtained in 1992 on the same configuration.
DTIC
Flow Visualization; Transonic Flow; Steady Flow; Wing Tips; Transonic Speed; Boundary Layer Separation; Particle Image Velocimetry

19980041521 Air Force Aerospace Research Pilot School, Edwards AFB, CA USA
Measurement of Controlled Focused Sonic Booms from Maneuvering Aircraft *Interim Report, Jan. 1993 - Jul. 1996*
Downing, Micah, Armstrong Lab., USA; Zamot, Noel, Air Force Aerospace Research Pilot School, USA; Moss, Chris, Air Force Aerospace Research Pilot School, USA; Morin, Daniel, Air Force Aerospace Research Pilot School, USA; Wolski, Ed, Air Force Aerospace Research Pilot School, USA; Chung, Sukhwan, Air Force Aerospace Research Pilot School, USA; Plotkin, Kenneth, Wyle Labs., USA; Maglieri, Domenic, Eagle Aeronautics, Inc., USA; Feb. 1998; 170p; In English
Contract(s)/Grant(s): AF Proj. 7757
Report No.(s): AD-A338070; AL/OE-WP-TR-1997-0185; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche
    In April 1994, the USAF Armstrong Laboratory in cooperation with USAF Test Pilot School conducted a measurement study of controlled focus boom generated by supersonic maneuvers. The objective of this study was to collect focus and post focus booms and to assess the ability of aircrews to control the placement of the focal region during basic maneuvers. Forty-nine supersonic passes were flown and included level linear acceleration, level turn, accelerating dives and climbout/pushover maneuvers. These flights were flown under calm and turbulent atmospheric conditions. Turbulent conditions had a defocusing effect which caused distortions in the focus region and resulted in smaller maximum overpressures. Sonic booms were collected by up to 25 Boom Event Analyzer Recorders (BEARs) placed in a 13,000 ft. linear array. The BEAR units were spaced 500 to 2,000 feet apart with the denser spacing at the expected focal region. This spacing was chosen to evaluate the thickness of both the focal and post-focal regions. of the 49 flights, a docus boom was placed within the array 37 times and within approximately 3,000 feet of the target point 27 times demonstrating the a bility to place controlled focus booms.
DTIC
Sonic Booms; Aircraft Maneuvers

Calspan-Buffalo Univ. Research Center, NY USA

Experimental Studies of Laminar, Transitional, and Turbulent Hypersonic Flows Over Elliptic Cones at Angles of Attack
Final Report, 1 Apr. 1995 - 30 Nov. 1997

Holden, Michael S., Calspan-Buffalo Univ. Research Center, USA; Jan. 1998; 58p; In English

Contract(s)/Grant(s): F49620-95-I-0292

Report No.(s): AD-A336868; CUBRC-2650F; AFRL-SR-BL-TR-98-0142; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

An experimental study has been performed to examine the three-dimensional characteristics of laminar, transitional and turbulent flow over an elliptic cone lifting body configuration. The experimental studies were performed at Mach numbers between 8 and 12 at Reynolds numbers, based on model length from 5 x 10(exp 5) to 5 x 10(exp 6). Detailed measurements of the distribution of heating and pressure were made along the leading edges and on the windward and leeward surfaces of the model with over 200 high-frequency, thin-film heat transfer gages and piezoelectric high-frequency pressure transducers. Measurements were also performed using temperature sensitive paints to further delineate the properties of the three-dimensional transitional flow. Schlieren photographs were also obtained of the transitional flow field over the models. Flowfield calibration measurements were made in the LENS facility with intrusive pitot and total heating transducers and nonintrusive electron beam, and infrared radiometer techniques. These data have been incorporated into the CUBRC/AFOSR Hypersonic Database which has been modified to run on the Windows platform.

DTIC

Turbulent Flow; Laminar Flow; Hypersonic Flow; Pressure Sensors; Flow Distribution

Lockheed Martin Tactical Aircraft Systems, Fort Worth, TX USA

Euler Technology Assessment - SPLITFLOW Code Applications for Stability and Control Analysis on an Advanced Fighter Model Employing Innovative Control Concepts

Jordan, Keith J., Lockheed Martin Tactical Aircraft Systems, USA; Mar. 1998; 64p; In English

Contract(s)/Grant(s): NAS1-96014; RTOP 522-22-11-01

Report No.(s): NASA/CR-1998-206943; NAS 1.26:206943; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report documents results from the NASA-Langley sponsored Euler Technology Assessment Study conducted by Lockheed-Martin Tactical Aircraft Systems (LMTAS). The purpose of the study was to evaluate the ability of the SPLITFLOW code using viscous and inviscid flow models to predict aerodynamic stability and control of an advanced fighter model. The inviscid flow model was found to perform well at incidence angles below approximately 15 deg, but not as well at higher angles of attack. The results using a turbulent, viscous flow model matched the trends of the wind tunnel data, but did not show significant improvement over the Euler solutions. Overall, the predictions were found to be useful for stability and control design purposes.

Author

Computational Fluid Dynamics; Unstructured Grids (Mathematics); Aerodynamic Stability; Angle of Attack; Fighter Aircraft; Viscous Flow; Turbulent Flow; Finite Volume Method; Navier-Stokes Equation; Inviscid Flow

Local isotropy in complex turbulent boundary layers at high Reynolds number

Saddoughi, Seyed G., Stanford Univ., USA; Journal of Fluid Mechanics; October 10, 1997; ISSN 0022-1120; Volume 348, pp. 201-245; In English; Copyright; Avail: Issuing Activity

Hot-wire measurements of the velocity fluctuations in complex turbulent boundary layers at several Reynolds numbers was conducted to continue the tests of the local-isotropy predictions of Kolgomorov's universal equilibrium theory in shear flows. The plane-of-symmetry flow upstream of a 4 ft diameter, 6 ft long circular cylinder placed with its axis vertical in the zero-pressure-gradient turbulent boundary layer of the test-section ceiling in the 80 ft x 120 ft Full-Scale Aerodynamics Facility at NASA Ames Research Center is studied. One decade of locally isotropic inertial subrange requires a ratio of the Kolgomorov to mean-shear timescales of not more than approximately 0.01.

EI

High Reynolds Number; Turbulent Boundary Layer; Boundary Layer Flow; Turbulent Flow; Reynolds Number; Strain Rate; Fighter Aircraft

NASA Langley Research Center, Hampton, VA USA

Computational/Experimental Aeroheating Predictions for X-33 Phase 2 Vehicle

Hamilton, H. Harris,II, NASA Langley Research Center, USA; Weilmuenster, K. James, NASA Langley Research Center, USA; Horvath, Thomas J., NASA Langley Research Center, USA; Berry, Scott A., NASA Langley Research Center, USA; 1998; 16p;

In English; Aerospace Sciences Meeting and Exhibit, 12-15 Jan. 1998, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): NASA/TM-1998-207290; NAS 1.15:207290; AIAA Paper 98-0869; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Laminar and turbulent heating-rate calculations from an 'engineering' code and laminar calculations from a 'benchmark' Navier-Stokes code are compared with experimental wind-tunnel data obtained on several candidate configurations for the X-33 Phase 2 flight vehicle. The experimental data were obtained at a Mach number of 6 and a freestream Reynolds number ranging from 1 to 8 x 10(exp 6)/ft. Comparisons are presented along the windward symmetry plane and in a circumferential direction around the body at several axial stations at angles of attack from 20 to 40 deg. The experimental results include both laminar and turbulent How. For the highest angle of attack some of the measured heating data exhibited a "non-laminar" behavior which caused the heating to increase above the laminar level long before 'classical' transition to turbulent flow was observed. This trend was not observed at the lower angles of attack. When the flow was laminar, both codes predicted the heating along the windward symmetry plane reasonably well but under-predicted the heating in the chine region. When the flow was turbulent the LATCH code accurately predicted the measured heating rates. Both codes were used to calculate heating rates over the X-33 vehicle at the peak heating point on the design trajectory and they were found to be in very good agreement over most of the vehicle windward surface.
Author

Computational Fluid Dynamics; Navier-Stokes Equation; Numerical Flow Visualization; Direct Numerical Simulation; X-33 Reusable Launch Vehicle; Reynolds Number; Transition Flow; Turbulent Flow; Hypersonic Boundary Layer; Hypersonic Vehicles

19980047520

Validation of a pseudo-sound theory for the pressure dilatation in DNS of compressible turbulence

Ristorcelli, J. R., NASA Langley Research Center, USA; Blaisdell, G. A., Purdue Univ., USA; 1997, pp. 29-14 to 29-18; In English; Copyright; Avail: Aeroplus Dispatch

This article addresses the validation using recent DNS results for compressible turbulence of the pressure dilatation (pd) which appears in the equation for the kinetic energy of a compressible turbulence. The article is primarily a study of the analysis of Ristorcelli (1995, 1997) in the light of a recent DNS by Blaisdell (1996). The representations were obtained using simple scaling arguments about the effects of compressibility and a singular perturbation idea and the methods of statistical fluid mechanics. While the results are expressed in the context of a statistical turbulence closure they provide, with very few phenomenological assumptions, an interesting and clear physical model for the scalar effects of compressibility. For a homogeneous turbulence with quasi-normal isotropic large scales the expressions derived are - in the small turbulent Mach number squared limit - exact. The analytical results, which do not have any unspecified empirical coefficients, are in good agreement with DNS results. The analytical results, which are a rigorous consequence of the low M(t)-squared assumptions, are shown to predict the proper scalings in homogeneous compressible turbulence.
Author (AIAA)

Proving; Compressible Flow; Turbulent Flow; Digital Simulation

19980047544

Development of the k-psi turbulence model

Cousteix, J., ONERA, Centre d'Etudes et de Recherches de Toulouse, France; Saint-Martin, V., ONERA, Centre d'Etudes et de Recherches de Toulouse, France; Messing, R., ONERA, Centre d'Etudes et de Recherches de Toulouse, France; Stuttgart, Univ., Germany; Bezard, H., ONERA, Centre d'Etudes et de Recherches de Toulouse, France; Aupoix, B., ONERA, Centre d'Etudes et de Recherches de Toulouse, France; 1997, pp. 13-24 to 13-29; In English; Copyright; Avail: Aeroplus Dispatch

This work is to develop a two-equation model of turbulence for aeronautical applications. Among others, the main required qualities of the model are robustness and an ability to predict the skin-friction and boundary layer separation. to achieve these goals, certain constraints were imposed, e.g., the logarithmic law of the wall or good behavior near the edge of a shear layer. A k-psi model has been developed in which the second variable is psi = epsilon/sq rt k. Comparisons with different experimental data are promising.
Author (AIAA)

K-Epsilon Turbulence Model; Fuselages; Transonic Flow; Skin Friction; Turbulent Flow

19980047572

Computational modelling of highly-loaded compressor cascade flows

Chen, W. L., UMIST, UK; Lien, F. S., UMIST, UK; Leschziner, M. A., UMIST, UK; 1997, pp. 1-13 to 1-18; In English; Copyright;

Avail: Aeroplus Dispatch, FROM

A computational study is presented which examines the predictive performance of nonlinear eddy-viscosity models (EVMs) and second-moment closure when applied to two blade geometries: a controlled-diffusion (CD) and a double-circular-arc (DCA) compressor blade, both operating at off-design conditions that include laminar leading-edge separation and transition. The study demonstrates that both the nonlinear EVM and second-moment closure possess characteristics which enable the models to give, at least for some important flow properties, superior predictive performance relative to a reference linear EVM. However, in the case of the DCA compressor blade, only the second-moment closure captures the substantial trailing-edge separation on the suction side and gives a credible representation of the boundary layers.
Author (AIAA)
Compressor Blades; Cascade Flow; Leading Edges; Laminar Flow Airfoils; Turbulence Models; Aerodynamic Loads

19980047764

Turbulence characteristics of a three-dimensional turbulent boundary layer on a rotating disk with an impinging jet
Kang, H. S., Seoul National Univ., Republic of Korea; Yoo, J. Y., Seoul National Univ., Republic of Korea; Choi, H., Seoul National Univ., Republic of Korea; 1997, pp. P3-107 to P3-112; In English; Copyright; Avail: Aeroplus Dispatch, FROM

An experimental study has been performed on a shear-driven 3D turbulent boundary layer over a rotating disk with an impinging jet located at the center of the disk, in order to investigate the turbulence characteristics of the 3D turbulent boundary layer developed in this flow. A relatively strong spanwise flow (radial outflow) generated from the impinging jet is added to the spanwise flow induced from the rotating disk, and thus the mean flow direction is significantly changed. Six components of the Reynolds stresses are measured by aligning the miniature X-wire probe to the mean velocity direction. The ratio of the wall-parallel shear stress magnitude to the turbulent kinetic energy in the near-wall region is significantly decreased by the impinging jet. In the case of the free rotating disk flow the shear stress vector lags behind the mean velocity gradient vector in the whole boundary layer, while the lag is reduced or the lead occurs as the impinging jet speed increases.
Author (AIAA)
Turbulent Boundary Layer; Three Dimensional Boundary Layer; Rotating Disks; Impingement; Jet Flow

19980047807

Amplification and reduction of turbulence in a heated jet/shock interaction
Jacquin, L., ONERA, Direction de l'Aerodynamique, France; Geffroy, P., ONERA, Direction de l'Aerodynamique, France; 1997, pp. L-12 to L-17; In English; Copyright; Avail: Aeroplus Dispatch, FROM

This paper presents an experimental study on the interaction of a heated jet with a normal shock wave in a Mach 1.6 nozzle. The jet is heated to maintain a uniform Mach number ahead of the shock wave. The jump in the TKE across the shock is studied by means of 2D-LDV measurements. Turbulence in the central part of the jet is amplified. Amplification factors are close to those predicted by the linear theory and do not depend on the jet temperature. In the mixing layer, the jump in the turbulence properties are strongly dependent on the jet temperature. This seems to be primarily due to changes in the mean shear across the shock. These results are discussed in the light of available theoretical results in the field.
Author (AIAA)
Turbulent Flow; Normal Shock Waves; Turbulent Jets; Shock Wave Interaction; Laser Doppler Velocimeters; Shear Layers

19980047827

Numerical study of flow past a wing-body junction with a realizable nonlinear EVM
Fu, S., Tsinghua Univ., China; Zhai, Z., Tsinghua Univ., China; Rung, T., Berlin, Technische Univ., Germany; Thiele, F., Berlin, Technische Univ., Germany; 1997, pp. 6-7 to 6-12; In English; Copyright; Avail: Aeroplus Dispatch, FROM

The flow passing a wing-body junction exhibits a number of interesting and important flow physics. In the nose region flow separation occurs and translates into a pair of horseshoe vortices along the junction as the flow moves downstream. In the downstream tail region separation may occur again due to flow expansion. This study calculates this flow with three eddy-viscosity models (EVMs), the standard BVM, and two nonlinear EVMs based on the explicit algebraic stress model. Computation results show that the nonlinear EVMs give a more favorable comparison with experiment than the linear EVM.
Author (AIAA)
Body-Wing Configurations; Horseshoe Vortices; Separated Flow; Flow Equations

19980047828

Utilization of the Garteur swept wing data base for turbulence models evaluation in boundary layer calculations
Doussinault, M., ONERA, France; Gleyzes, C., ONERA, France; Aupoix, B., ONERA, France; Gooden, J. H. M., NLR, Nether-

lands; 1997, pp. 6-1 to 6-6; In English; Copyright; Avail: Aeroplus Dispatch

Three-dimensional flows are difficult test cases for boundary layer turbulence modeling. Algebraic, two- and five-equation models are tested here, in one or two-layer approaches, on the suction and the pressure side of the Garteur AD/AG07 wing. Initial and boundary conditions are defined in direct and inverse mode. Some examples of results (skin friction coefficients, shape factors, turbulence kinetic energy profiles) are shown at 68 percent of the span, where the flow is near separation at the suction side trailing edge, and accelerated in the last 30 percent of chord at the pressure side. The mixing-length model gives good skin friction predictions for this type of 3D flow. The two-layer approach (algebraic, five-equation) and the k-epsilon models are disappointing. The model proposed by Menter (1993), used in inverse mode, is the most efficient of the tested models, but has also some difficulties in accurately predicting this type of flow.
Author (AIAA)
Swept Wings; Data Bases; K-Epsilon Turbulence Model; Boundary Layer Equations; Skin Friction; K-Omega Turbulence Model

19980047853

3D direct simulation of the shock-boundary layer interaction and von Karman instability in transonic flow around a wing

Bouhadji, A., Toulouse, Inst. de Mecanique des Fluides, France; Braza, M., Toulouse, Inst. de Mecanique des Fluides, France; 1997, pp. P1-31 to P1-36; In English; Copyright; Avail: Aeroplus Dispatch

The numerical simulation of a transonic flow around a wing of constant section (NACA0012) is performed at Mach number 0.85, Reynolds number 10,000, and zero angle of incidence. The full time-dependent Navier-Stokes equations are solved in 2D and 3D by using a finite-difference method. This flow shows the spontaneous appearance of a von-Karman instability in the near wake. It is found that this instability results from the shock-boundary-layer interaction occurring in the vicinity of the trailing edge. The natural disturbances due to this interaction lead further downstream to amplification of the instability, which leads to the appearance of an alternating vortex pattern. The spacial evolution of this mode is studied and its maximum amplification rate is localized in the near wake. A thorough study of the instability process is performed in the 2D and 3D flow configurations. A detailed cartography of the flow through the instantaneous 2D and 3D fields of Mach number, density, temperature, velocity components, and pressure allow the tracking of the shock-boundary-layer interaction and of the formation of coherent vortices.
Author (AIAA)
Transonic Flow; Von Karman Equation; Flow Stability

19980047854

Investigation of the turbulent wind on the aerodynamic characteristics of wind turbines and sails

Breard, C., Athens, National Technical Univ., Greece; Voutsinas, S. G., Athens, National Technical Univ., Greece; Hauville, F., Le Havre, Univ., France; Huberson, S., Le Havre, Univ., France; 1997, pp. P1-25 to P1-30; In English; Copyright; Avail: Aeroplus Dispatch

An extension to the aeroelastic codes based on the vortex particle and BEMS is propsoed in order to account for atmospheric turbulence. The interaction between the turbulent inflow and the turbulent wake is considered by a simple large eddy simulation model. The methodology is applied to wind turbines and sails. It is found that the vortical flow interaction added to the turbulent inflow contributes to strong turbulent wakes.
AIAA
Turbulent Flow; Aerodynamic Characteristics; Turbulence Effects; Lifting Bodies; Wind Effects; Trailing Edges

19980047855

Effects of first-order turbulence models applied to flows around lifting airfoils

Khris, S., Inst. de Recherche sur les Phenomenes Hors Equilibre, France; Marcillat, J., Inst. de Recherche sur les Phenomenes Hors Equilibre, France; 1997, pp. P1-19 to P1-24; In English; Copyright; Avail: Aeroplus Dispatch

A numerical study is conducted in order to evaluate the ability of different turbulence models, based on the eddy viscosity concept, to predict two air flows - a trailing edge breakdown and a transition bubble separation. The models are deduced from the arrangement of Boussinesq linear and Speziale nonlinear Reynolds stresses with standard k-epsilon and RNG k-epsilon models. It is found that the mean flow prediction improvements, especially the intensity of the backflow, are effected by taking into account the RNG k-epsilon model associated with the nonlinear Reynolds stress formulation. On the other hand, the normal stress anisotropy level cannot be accurately predicted by any of the models used.
Author (AIAA)
Lifting Bodies; Trailing Edges; K-Epsilon Turbulence Model; Reynolds Equation

19980047856

Computation of the unsteady and laminar-turbulent flow in a low-pressure turbine

Eulitz, Frank, German Aerospace Research Establishment, Inst. for Propulsion Technology, Germany; Engel, Karl, German Aerospace Research Establishment, Inst. for Propulsion Technology, Germany; 1997, pp. P1-11 to P1-17; In English; Copyright; Avail: Aeroplus Dispatch

A 3D time-accurate Reynolds averaged Navier-Stokes solver is applied to study the wake interaction in a low pressure turbine along a precalculated streamtube near midspan. The model turbine configuration consists of three-stator and two-rotor rows of equal pitch. Laminar-turbulent transition phenomena are incorporated qualitatively by coupling the Abu-Ghanam Shaw transition correlation with a two-layer version of the Spalart and Allmaras one-equation turbulence model. In order to account for by-bass transition induced by migrating wakes, the transport equation for the turbulent kinetic energy is solved in addition. The numerical methods used to obtain a steady-state initialization, and the time-periodic solutions are briefly described. Instantaneous entropy plots are presented to monitor the wake migration and interaction with downstream boundary layers and wakes. It is shown that the interaction gives rise to a substantial variation of the skin friction parameter (order of 40 percent).

Author (AIAA)

Transition Flow; Unsteady Aerodynamics; Turbulent Flow; Turbine Blades; Interactional Aerodynamics; Turbulence Models

19980047959

Instabilities of stationary inviscid compressible flow around an airfoil

van Buuren, R., Twente, Univ., Netherlands; Kuerten, J. G. M., Twente, Univ., Netherlands; Geurts, B. J., Twente, Univ., Netherlands; Journal of Computational Physics; Dec. 1997; ISSN 0021-9991; Volume 13, no. 2, pp. 520-539; In English; Copyright; Avail: Aeroplus Dispatch

The possiblity of obtaining a machine accurate steady-state solution to the Euler equation with a minmod limiter and an implicit time-stepping scheme is shown. Consideration is given to an asymmetric version of the minmod limiter which removes the nondifferentiability in a region where the quotient of the gradients of the solution of adjacent cells is near one. It is argued that the stall of convergence of e.g., a time explicit method, is caused by a phyical instability rather than by the minmod limiter. The final values of the residual obtained with the factorization scheme depend on the CFL number. A threshold of CFL of 1000, above which the solution does not change, is encountered. Fast convergence to machine accuracy can be obtained by starting with a high CFL number and decreasing the CFL number.

AIAA

Airfoil Profiles; Inviscid Flow; Flow Stability; Compressible Flow; Euler Equations of Motion; Steady Flow

19980048085

Reduced-order aerodynamic model and its application to a nonlinear aeroelastic system

Tang, Deman, Duke Univ., USA; Conner, Mark D., Duke Univ., USA; Dowell, Earl H., Duke Univ., USA; Journal of Aircraft; Apr. 1998; ISSN 0021-8669; Volume 35, no. 2, pp. 332-338; In English
Contract(s)/Grant(s): F49620-97-1-0063; NAG1-1569; Copyright; Avail: Aeroplus Dispatch, FROM

Starting from a finite state model for a two-dimensional aerodynamic flow over an airfoil, the eigenmodes of the aerodynamic flow are determined. Using a small number of these aerodynamic eigenmodes, i.e., a reduced-order model, the aeroelastic model is formed by coupling them to a typical section structural model with a trailing-edge flap. A free-play nonlinearity is modeled. Results are shown from the finite state model, the reduced-order model, and previous theoretical and experimental work. All results are in good agreement.

Author (AIAA)

Two Dimensional Flow; Aeroelasticity; Aerodynamic Configurations; Aerodynamic Loads

19980048181

Design of hydrodynamic cascades for any range of input parameters *Postroenie gidrodinamicheskikh reshetok dlya zadannogo diapazona vkhodnykh parametrov*

Il'inskij, N. B., Kazanskij Gosudarstvennyj Univ., Russia; Ismagilova, G. R., Kazanskij Gosudarstvennyj Univ., Russia; Potashev, A. V., Kazanskij Gosudarstvennyj Univ., Russia; Aviatsionnaya Tekhnika; 1997; ISSN 0579-2975, no. 3, pp. 40-43; In Russian; Copyright; Avail: Aeroplus Dispatch

A method is developed for designing a cascade that would have the desired characteristics over a specified range of input flow parameters. The approach used here is based on solving the inverse boundary value problem of fluid mechanics for specified velocity distributions that are characteristic of two cascade flow regimes. The method is illustrated by an example.

AIAA

Aircraft Design; Cascade Flow; Flow Characteristics; Fluid Mechanics; Velocity Distribution

19980048226

Fully three-dimensional transition prediction on swept wings in transonic flows

Langlois, Marc, Bombardier Aerospace Group, Canada; Masson, Christian, Ecole de Technologie Superieure, Canada; Paraschivoiu, Ion, Ecole Polytechnique, Canada; Journal of Aircraft; Apr. 1998; ISSN 0021-8669; Volume 35, no. 2, pp. 254-259; In English; Copyright; Avail: Aeroplus Dispatch

A stability analyzer for transition prediction over arbitrary three-dimensional wings operating in the transonic regime is proposed. This analyzer is used to illustrate the importance of including the effects of spanwise pressure gradient in transition predictions over such configurations. To this end, three calculation methods were employed: 1) a three-dimensional Euler solver, 2) a three-dimensional boundary-layer solver, and 3) a numerical method for the solution of the linear stability equations based on the temporal formulation. The influence of spanwise pressure gradients is illustrated by the application of this stability analyzer to the flow about the NASA AMES and ONERA-M6 wings. The pertinence of using a fully three-dimensional method rather than the simpler conical-flow calculations is demonstrated. The differences between the fully three-dimensional and conical-flow results are of the same order as the curvature or nonparallel effects.

Author (AIAA)

Swept Wings; Transonic Flow; Three Dimensional Bodies; Wing Profiles; Systems Stability; Transition Flow

19980048228

Coupled force and moment parameter estimation for aircraft

Cho, Yongseung, Wichita State Univ., USA; Nagati, M. G., Wichita State Univ., USA; Journal of Aircraft; Apr. 1998; ISSN 0021-8669; Volume 35, no. 2, pp. 247-253; In English
Report No.(s): AIAA Paper 96-0776; Copyright; Avail: Aeroplus Dispatch

This paper presents the full application of the multipoint aerodynamic model for parameter estimation in high-angle-of-attack and high-angular-rate flight regimes. This model is intended for use in simulation and control design, and for the study of aerodynamic force distributions on the surfaces of an aircraft. The estimation technique used to illustrate the approach is simple regression with the equation error approach. The multipoint model comprises a set of new parameters describing the aerodynamic force distribution along individual surface components of the aircraft. The aim of this study is to demonstrate that this model allows coupling among the three force and three moment components, which is accounted for in the model. This means that the parameters associated with the six-component equations are thus treated simultaneously. Another advantage of this approach is that the model allows each individual force-generating surface element of the aircraft to contribute independently to the total force and moment, rather than some average of these contributions relative to the c.m. The method is applied to measurements from spin flight test data conducted with a light general aviation aircraft. The results indicate that the method is capable of reproducing, with reasonable accuracy, the force and moment measurements obtained from a flight other than the one used in the parameter estimation.

Author (AIAA)

Parameter Identification; Aerodynamic Configurations; Angle of Attack; Aircraft Configurations; Flight Tests; General Aviation Aircraft

19980048230

Hybrid airfoil design method to simulate full-scale ice accretion throughout a given alpha range

Saeed, Farooq, Illinois, Univ., Urbana, USA; Selig, Michael S., Illinois, Univ., Urbana; Bragg, Michael B., Illinois, Univ., Urbana; Journal of Aircraft; Apr. 1998; ISSN 0021-8669; Volume 35, no. 2, pp. 233-239; In English
Contract(s)/Grant(s): NCC3-408
Report No.(s): AIAA Paper 97-0054; Copyright; Avail: Aeroplus Dispatch

A design procedure is presented for hybrid airfoils with full-scale leading edges and redesigned aft sections that exhibit full-scale airfoil water droplet-impingement characteristics throughout a given angle of attack or alpha range. The design procedure is an extension of a previously published method in that it not only allows for subcritical and viscous-flow analysis in the design but is also capable of off-design droplet-impingement simulation through the use of a flap system. The limitations of the flap-system-based design for simulating both on- and off-design full-scale droplet-impingement characteristics and surface-velocity dis-

tribution are discussed with the help of specific design examples. In particular, this paper presents the design of two hybrid airfoils at two different angles of attack, such that they simulate both the full-scale velocity distribution as well as droplet-impingement characteristics at the respective design angles of attack. Both of the hybrid airfoils are half-scale airfoil models with the nose section matching the full-scale coordinates of the Learjet 305 airfoil back to 5 percent chord on the upper surface and 20 percent chord on the lower surface. The effect of flap deflection and droplet size on droplet-impingement characteristics is also presented to highlight the important limitations of the present method both on- and off-design. This paper also discusses important compromises that must be made to achieve full-scale ice accretion simulation throughout a desired alpha range and suggests alternatives such as applying a multipoint design approach.

Author (AIAA)

Airfoil Profiles; Ice Formation; Leading Edges; Impingement; Aircraft Accidents; Aircraft Icing

19980048231

Cellular structures in the flow over the flap of a two-element wing

Yon, Steven A., San Diego State Univ., USA; Katz, Joseph, San Diego State Univ., USA; Journal of Aircraft; Apr. 1998; ISSN 0021-8669; Volume 35, no. 2, pp. 230-232; In English

Contract(s)/Grant(s): NCA2-786; Copyright; Avail: Aeroplus Dispatch

Flow visualization information and time-dependent pressure coefficients were recorded for the flow over a two-element wing. The investigation focused on the stall onset, particularly at a condition where the flow is attached on the main element but separated on the flap. At this condition, spanwise separation cells were visible in the flow over the flap, and time-dependent pressure data were measured along the centerline of the separation cell. The flow visualizations indicated that the spanwise occurrence of the separation cells depends on the flap (and not wing) aspect ratio.

Author (AIAA)

Flow Visualization; Flaps (Control Surfaces); Wind Tunnel Tests; Pressure Measurement; Pressure Distribution

19980048233

Instantaneous crossflow topology on a delta wing in the presence of vortex breakdown

Cipolla, K. M., Lehigh Univ., USA; Rockwell, D., Lehigh Univ., USA; Journal of Aircraft; Apr. 1998; ISSN 0021-8669; Volume 35, no. 2, pp. 218-223; In English; Copyright; Avail: Aeroplus Dispatch

The crossflow structure of the leading-edge vortices on a delta wing is investigated via particle image velocimetry. The transformation of the streamline topology as the vortex breakdown position moves up- or downstream of its nominal value is characterized by comparing instantaneous images. While the streamline patterns are distinctly different depending on the location of vortex breakdown relative to the field of view, contours of constant vorticity do not exhibit such distinctions. Several classes of instantaneous streamline topology can exist in the crossflow plane. These topologies, which involve various combinations of limit cycles and loci, indicate the importance of considering the instantaneous nature of both the vorticity contours and streamlines when describing the flow physics.

Author (AIAA)

Cross Flow; Topology; Delta Wings; Vortex Breakdown; Leading Edges

19980048236

Gurney flap experiments on airfoils, wings, and reflection plane model

Myose, Roy, Wichita State Univ., USA; Papadakis, Michael, Wichita State Univ., USA; Heron, Ismael, Wichita State Univ., USA; Journal of Aircraft; Apr. 1998; ISSN 0021-8669; Volume 35, no. 2, pp. 206-211; In English

Report No.(s): AIAA Paper 97-0034; Copyright; Avail: Aeroplus Dispatch

The effect of Gurney flaps on two-dimensional airfoils, three-dimensional wings, and a reflection plane model was investigated. There have been a number of studies on Gurney flaps in recent years, but these studies have been limited to two-dimensional airfoil sections. A comprehensive investigation on the effect of Gurney flaps for a wide range of configurations and test conditions was conducted at Wichita State University. A symmetric NACA 0011 and a cambered GA(W)-2 airfoil were used during the single-element airfoil part of this investigation. The GA(W)-2 airfoil was also used during the two-element airfoil study with a 25 percent chord slotted flap deflected at 10, 20, and 30 deg. Straight and tapered reflection plane wings with natural laminar flow (NLF) airfoil sections were tested for the three-dimensional wing part of this investigation. A fuselage and engine were attached to the tapered NLF wing for the reflection plane model investigation. In all cases the Gurney flap improved the maximum lift coefficient compared to tbe baseline clean configuration. However, there was a drag penalty associated with this lift increase.

Author (AIAA)

Wing Profiles; Low Speed Wind Tunnels; Wing Flaps; Flat Plates

Accuracy of Aerodynamic Model Parameters Estimated from Flight Test Data

Morelli, Eugene A., Lockheed Martin Engineering and Sciences Co., USA; Klein, Vladislav, NASA Langley Research Center, USA; Journal of Guidance, Control, and Dynamics; 1997; Volume 20, No. 1, pp. 74-80; In English

An important put of building mathematical models based on measured date is calculating the accuracy associated with statistical estimates of the model parameters. Indeed, without some idea of this accuracy, the parameter estimates themselves have limited value. An expression is developed for computing quantitatively correct parameter accuracy measures for maximum likelihood parameter estimates when the output residuals are colored. This result is important because experience in analyzing flight test data reveals that the output residuals from maximum likelihood estimation are almost always colored. The calculations involved can be appended to conventional maximum likelihood estimation algorithms. Monte Carlo simulation runs were used to show that parameter accuracy measures from the new technique accurately reflect the quality of the parameter estimates from maximum likelihood estimation without the need for correction factors or frequency domain analysis of the output residuals. The technique was applied to flight test data from repeated maneuvers flown on the F-18 High Alpha Research Vehicle. As in the simulated cases, parameter accuracy measures from the new technique were in agreement with the scatter in the parameter estimates from repeated maneuvers, whereas conventional parameter accuracy measures were optimistic.
Author
Accuracy; Mathematical Models; Aerodynamic Characteristics; Estimating; Algorithms

The use of linear and non-linear low Reynolds number models in the calculations of flow in a RAE M2129 S-duct

Marquis, A. J., Imperial College of Science, Technology and Medicine, UK; Ong, L. Y., Imperial College of Science, Technology and Medicine, UK; 1997, pp. 3-7 to 3-12; In English; Copyright; Avail: Aeroplus Dispatch

The RAE M2129 semi-circular-to-circular diffusing duct, one of the AGARD-AR-270 (1991) research test cases, is investigated. The incompressible velocity field was measured by Ong (1997) using a refractive-index matching LDV technique at a Reynolds number in excess of 33,000. Initial calculations using the Launder-Sharma k-epsilon model and the Gibson-Dafa'Alla q-zeta model were also performed by Marquis and Ong (1996). Although both models have demonstrated their superiority over the standard wall-function treatment in capturing the separation region, the extent of the separation was still far from satisfactory. This paper summarises further attempts to model this flow, and the results using the Gibson and Dafa'Alla (1994) linear q-zeta model, the Cotton and Kitwin (1995) k-epsilon model with and without Yap's Correction (Launder (1988), a nonlinear q-zeta model (Ong (1997), and a Reynolds stress model with wall functions are presented and discussed.
Author (AIAA)
Ducted Flow; Low Reynolds Number; Fighter Aircraft; Directional Stability; Aircraft Engines; Duct Geometry

On the three-dimensional evoution of a wake subjected to cross-shear

Beharelle, S., CEAT, France; Delville, J., CEAT, France; Bonnet, J.-P., CEAT, France; 1997, pp. 2-25 to 2-30; In English; Copyright; Avail: Aeroplus Dispatch

We analyze the influence of the transverse shear on the development of wake flows. Several experiments are carried out in a specially designed wind tunnel to generate two coaxial jets with counterswirl. The swirl level that introduces the transverse shear, and the exit velocity can be independently adjusted for each jet. by setting the same longitudinal component velocity to the two jets, a wakelike flow can be observed immediately downstream of the trailing edge. by imposing a counterswirl on these two flows, a constant shear in the radial direction is created. Thus a wake flow is obtained that develops in the midst of constant shear perpendicular to the direction of the global convection.
Author (AIAA)
Cross Flow; Turbulent Wakes; Shear Flow; Wind Tunnel Tests; Coaxial Flow; Flow Stability

A study of coherent structures in the wake of a heated cylinder at x/D = 30

Pons, M. D., Univ. Rovira i Virgili, Spain; Ferre, J. A., Univ. Rovira i Virgili, Spain; 1997, pp. 2-7 to 2-12; In English; Copyright; Avail: Aeroplus Dispatch

Temperature, theta, and two components of velocity, either u and v or u and w, are measured simultaneously in a turbulent wake 30 diameters downstream of a slightly heated cylinder in order to study the topology of the Karman vortex street. A procedure for the complete 3D reconstruction of the dynamic (u, v, and w) and thermal (theta) field of coherent motions using a limited set of sensors is developed, and the main features of the Karman vortices are obtained. The velocity and temperature footprints of the Karman vortices are obtained in a vertical plane. Also, 3D maps of temperature and omega-z vorticity are presented. The internal circulation of the Karman vortices is examined using artificial flow visualization by particle tracking.
Author (AIAA)

Turbulent Wakes; Cylinders; Aerodynamic Heating; Karman Vortex Street; Flow Visualization

19980048577

The effect of the Reynolds number on the turbulence structure in a circular cylinder far-wake

Zhou, Y., Hong Kong Polytechnic Univ., Hong Kong; Antonia, R. A., Newcastle, Univ., Australia; Tsang, W. K., Hong Kong Polytechnic Univ., Hong Kong; 1997, pp. 2-1 to 2-6; In English; Copyright; Avail: Aeroplus Dispatch

The effect of the Reynolds number in a turbulent plane far wake is investigated for two values of Re-theta (based on the freestream velocity and the momentum thickness), i.e., 1350 and 4600, using two orthogonal arrays of 16 X-wires, eight in the (x, y)-plane and eight in the (x, z) plane. It is observed that as the Reynolds number increases, the magnitudes of the measured Reynolds stresses increase, as does the size of two-point correlation iso-contours. Discernible differences are also observed in pdf, spectra, and 3D topologies. The Reynolds number dependence seems to vanish when Re-theta is not less than 5000.
Author (AIAA)

Turbulent Flow; Circular Cylinders; Turbulent Wakes; Reynolds Number; Shear Flow; Aerodynamic Characteristics

19980048578

The effect of Reynolds number on boundary layer turbulence

DeGraaf, David B., Stanford Univ., USA; Webster, Donald R., Stanford Univ., USA; Eaton, John K., Stanford Univ., USA; 1997, pp. 1-19 to 1-23; In English
Contract(s)/Grant(s): N00014-94-1-0070; Copyright; Avail: Aeroplus Dispatch, FROM

A new facility for studying high Reynolds number, incompressible turbulent boundary layer flows has been constructed. It consists of a moderately sized wind tunnel, completely enclosed by a pressure vessel, which can raise the ambient air pressure in and around the wind tunnel to eight atmospheres. This results in a Reynolds number range of about 20:1, while maintaining incompressible flow. Results are presented for the zero pressure gradient flat plate boundary layer over a momentum thickness Reynolds number range of 1500 to 15,000. Scaling issues for high Reynolds number nonequilibrium boundary layers are discussed, with data comparing the 3D turbulent boundary layer flow over a swept bump at Reynolds numbers of 3800 and 8600. It is found that successful prediction of these types of flows must include length scales which do not scale on Reynolds number, but are inherent to the geometry of the flow.
Author (AIAA)

Turbulent Boundary Layer; High Reynolds Number; Wind Tunnel Tests; Incompressible Flow; Pressure Gradients; Flow Geometry

19980048608

Non-linear v-squared(bar)-f modeling with application to aerodynamic flows

Lien, F. S., UMIST, UK; Durbin, P. A., Stanford Univ., USA; Parneix, S., Stanford Univ., USA; 1997, pp. 6-19 to 6-24; In English; Copyright; Avail: Aeroplus Dispatch

The v-squared(bar)-f or (k-epsilon-v-squared(bar)) model is investigated to quantify its predictive performance on two high-lift configurations: 2D flow over a single-element airfoil, involving closed-type separation, and 3D flow over a prolate spheroid, involving open-type separation. A 'code-friendly' modification is proposed to enhance the numerical stability, in particular, for explicit and uncoupled flow solvers. As a result of introducing Reynolds-number dependence into a coefficient of the epsilon-equation, the skin-friction distribution for the by-pass transitional flow over a flat plate is better predicted. In order to improve deficiencies arising from the Boussinesq approximation, a nonlinear stress-strain constitutive relation is adopted, in which the only one free constant is calibrated on the basis of DNS data, and the Reynolds-stress anisotropy near the wall is fairly well represented.
Author (AIAA)

Aerodynamic Configurations; Two Dimensional Flow; Turbulence Models; Flow Coefficients; Transition Flow

Validation of linear and non-linear low-Re turbulence models in shock/boundary layer interaction

Barakos, G., UMIST, UK; Drikakis, D., UMIST, UK; 1997, pp. 32-19 to 32-24; In English; Copyright; Avail: Aeroplus Dispatch

Validation of linear and recently developed nonlinear eddy-viscosity models in transonic flows featuring shock/boundary layer interaction and separation is presented. The accuracy of the models is assessed against experimental results for two transonic flow cases, one over an axisymmetric bump and another in a channel with a bump on the lower wall. Discretization of the mean flow and turbulence transport equations is obtained by a characteristics-based scheme, third-order in accuracy. For the time integration an implicit unfactored method is used. The study reveals that the numerical predictions for the shock/boundary layer interaction are improved by the present nonlinear models.

Author (AIAA)

K-Epsilon Turbulence Model; Proving; Eddy Viscosity; Transonic Flow; Compressible Flow

Computations of compressible turbulent shear flows with multiple-time-scale models

Hadjadj, A., Rouen, INSA, St.-Etienne du Rouvray, France; Vandromme, D., Rouen, INSA, St.-Etienne du Rouvray, France; De Chanterac, L., DRET, France; 1997, pp. 32-1 to 32-6; In English; Copyright; Avail: Aeroplus Dispatch

This paper concerns computations of compressible turbulent shear flows with multiple-scale models. Several improvements in computations of shear flows at high convective Mach number are obtained with multiple-scale models. The multiscale modeling permits to understand better the physics concerning regions of strong nonequilibrium turbulent flows. In this study, two aspects have been examined: the compressibility caused by strong Mach number variations and the anisotropy of turbulent flow. The results show that the RSM model with multiscale formulation is able to integrate simultaneously these two effects. This model is proved numerically stable and gives better results compared to those issued from a classical second-moment closure.

Author (AIAA)

Computational Fluid Dynamics; Compressible Flow; Shear Flow; Turbulent Flow; Scale Models; Aerothermodynamics

Experiments for the effects of curvature and pressure gradient on the turbulent wake of a flat plate

Starke, A. R., Delft Univ. of Technology, Netherlands; Henkes, R. A. W. M., Delft Univ. of Technology, Netherlands; Tummers, M. J., Delft Univ. of Technology, Netherlands; 1997, pp. 31-13 to 31-18; In English; Copyright; Avail: Aeroplus Dispatch

In an earlier study (Tummers, 1995) experimental data were presented for the turbulent near wake of a flat plate subjected to an adverse pressure gradient. This paper presents new data on the simultaneous effects of curvature and adverse pressure gradient. The results are compared with new data for the wake under zero pressure gradient. The measurements were performed with a three-component laser-Doppler velocimeter, and include the mean velocity, Reynolds stresses, and triple velocity correlations. Temporal correlation functions of the streamwise velocity component were measured to determine the dissipation length scales. These data can be used as a testcase for turbulence models.

Author (AIAA)

Curvature; Pressure Gradients; Turbulent Wakes; Flat Plates; Reynolds Stress; Shear Stress

Prediction of 3D supersonic flows including crossflow separation using low-Reynolds number turbulence models

Deniau, Hugues, ONERA, Centre d'Etudes et de Recherches de Toulouse, France; Thivet, Frederic, ONERA, Centre d'Etudes et de Recherches de Toulouse, France; Moschetta, Jean-Marc, ONERA, Centre d'Etudes et de Recherches de Toulouse, France; 1997, pp. 29-19 to 29-24; In English; Copyright; Avail: Aeroplus Dispatch

This paper deals with the capability of a wide range of turbulence models to predict the crossflow separation and the skin friction in 3D supersonic flows around slender bodies at angle of attack. Well-known algebraic and two-equation models are briefly presented. Reynolds-stress models (RSM) are then reviewed, focusing on the principles they are built on. Existing low-Reynolds nonlinear RSM are shown to be unable to predict a flat plate boundary layer for high Reynolds number. Two ways are followed to supply this deficiency: one consists of building a new low-Reynolds nonlinear RSM fitted to correctly predict the flat plate boundary layer and the other consists of building two-layer low-Reynolds linear RSM/high-Reynolds nonlinear RSM models. Computed results around ogive-cylinders are presented and compared to each other and to experimental data. Two-layer RSM are shown to be valid for moderate and high angles of attack even when two-equation model failures arise.

Author (AIAA)

Three Dimensional Flow; Supersonic Flow; Cross Flow; Separated Flow; Low Reynolds Number; K-Epsilon Turbulence Model

14

Localization and analysis of large scale structures by a wavelet transform technique in a supersonic turbulent mixing layer

Dupont, P., Inst. de Recherche sur les Phenomenes Hors d'Equilibre, France; Muscat, P., Inst. de Recherche sur les Phenomenes Hors d'Equilibre, France; Dussauge, J. P., Inst. de Recherche sur les Phenomenes Hors d'Equilibre, France; 1997, pp. 29-8 to 29-13; In English; Copyright; Avail: Aeroplus Dispatch

The space-time description of the organized structures in a supersonic mixing layer with a convective Mach number of 0.62 is given. Fourier analysis is shown to give only global information. A method based on wavelet transform is proposed to perform a space-time analysis localized in time. It is used to detect and to analyze these structures, in particular to determine the convection velocity associated with large scales. Characteristic time and length scales are given and compared with the scales deduced from the spectral analysis. The results are used to separate the contribution of the large scales to the turbulent signal.
Author (AIAA)

Supersonic Flow; Turbulent Mixing; Mixing Layers (Fluids)

Mixing enhancement in supersonic rectangular jets

Samimy, M., Ohio State Univ., Columbus, USA; Kim, J.-H., Ohio State Univ., Columbus; Clancy, P. S., Ohio State Univ., Columbus; 1997, pp. 29-1 to 29-6; In English
Contract(s)/Grant(s): NAG3-1724; NAG3-1986; Copyright; Avail: Aeroplus Dispatch

Rectangular nozzles with one modified trailing edge were used to generate large scale streamwise vortices in order to enhance mixing in supersonic jets. The modifications are simple cut-outs in the plane of the nozzle wall, and act to induce streamwise vortices. The mixing performances of a rectangular nozzle with design Mach number 2 and with various trailing edges were evaluated using flow visualizations in flow regimes ranging from moderately overexpanded $Mj = 1.5$ to moderately underexpanded $Mj = 2.5$. The results indicate that the overall mixing can be significantly increased in underexpanded operating regimes with modifications in just one trailing edge. The results, however, are not as clear-cut in overexpanded flow regimes. The trailing edge modifications do not significantly alter the overall mixing in the ideally expanded flow regime. This is consistent with the hypothesis that only in off-design flow regimes streamwise vortices would be generated due to the induced cross-stream velocity.
Author (AIAA)

Supersonic Jet Flow; Nozzle Geometry; Trailing Edges; Jet Mixing Flow

Grid turbulence in compressible flow

Zwart, P. J., Ottawa, Univ., Canada; Waterloo, Univ., Canada; Tavoularis, S., Ottawa, Univ., Canada; Waterloo, Univ., Canada; Budwig, R., Idaho, Univ., Moscow; Experiments in Fluids; Dec. 1997; ISSN 0723-4864; Volume 23, no. 6, pp. 520-522; In English; Copyright; Avail: Aeroplus Dispatch

This paper describes an experimental investigation of the effects of mean compressibility on the structure and the decay characteristics of grid turbulence. The experiments comprise laser Doppler velocimetry measurements of an approximately homogeneous isotropic turbulence field in subsonic compressible flow, with the Mach number ranging from 0.15 to 0.7. The results reveal that the turbulence intensity and decay characteristics are influenced by mean compressibility. Experience with the high subsonic and supersonic regimes is also reported.
Author (AIAA)

Compressible Flow; Computational Grids; Laser Doppler Velocimeters; Compressibility Effects; Isotropic Turbulence

Computation of the aerodynamic characteristics of a subsonic transport

Troeger, Lillianne P., Old Dominion Univ., USA; Selby, Gregory V., Old Dominion Univ., USA; Journal of Aircraft; Apr. 1998; ISSN 0021-8669; Volume 35, no. 2, pp. 183-190; In English; Copyright; Avail: Aeroplus Dispatch

An advanced low-order panel method, VSAERO, has been applied to a full-configuration transport aircraft. Wing pressure distributions, as well as lift, drag, and pitching moment coefficients, calculated for the full configuration are compared with experimental data. In addition, the effect of selected vehicle components on aircraft forces and moments was investigated. The results for the complete configuration were compared with those from several partial model configurations. It is shown that the wing-sur-

face pressure distributions and pitching moment coefficient are predicted well by VSAERO. The lift coefficient is consistently overpredicted by the code, as expected for inviscid calculations.
Author (AIAA)

Aerodynamic Characteristics; Subsonic Aircraft; Transport Aircraft; Panel Method (Fluid Dynamics); Aircraft Configurations; Inviscid Flow

03
AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

19980041398 NYMA, Inc., Egg Harbor, NJ USA

Test and Evaluation Plan for Selection Tests for CTX 5000 Screeners *Final Report*

Cormier, S., NYMA, Inc., USA; Fobes, J. L., NYMA, Inc., USA; May 1997; 62p; In English

Contract(s)/Grant(s): DTFA03-94-C-00012

Report No.(s): PB98-125727; DOT/FAA/AR-97/51; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The effectiveness of a screener selection instrument as an element of the Screener Proficiency Evaluation and Reporting System (SPEARS) for checked baggage screening with the CTX 5000 is evaluated. Testing is designed to determine whether a potential screener selection test is valid, reliable, and usable as a selection tool for CTX 5000 screeners. Testing will be conducted at airports where the CTX 5000 system, with functioning integrated Threat Image Projection (TIP) software, is deployed.
NTIS

Evaluation; Airport Security; Explosives Detection; Personnel; Personnel Selection; Acceptability; Security; Education

19980041424 Federal Aviation Administration, William J. Hughes Technical Center, Atlantic City, NJ USA

Cognitive Model of X-ray Security Screening: Selection Tests to Identify Applicants Posessing Core Aptitudes *Final Report*

Neiderman, E. C., NYMA, Inc., USA; Fobes, J. L., NYMA, Inc., USA; Sep. 1997; 110p; In English

Report No.(s): PB98-125735; DOT/FAA/AR-97/63; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The report presents a cognitive model of the perceptual and cognitive processes involved in X-ray screening. The model is used to identify 51 psychometric tests that are potentially useful for selection of X-ray screeners. Selection tests are standardized psychometric instruments used to measure specific aptitudes and abilities related to cognitive functioning and job performance. Selection tests may improve the performance of X-ray screeners by ensuring that individuals with the aptitude for success are placed at security checkpoints. The report describes the purpose, procedure, and items of the 51 tests. The tests are evaluated for validity and reliability and against a set of practical considerations. A battery of 14 tests is recommended for operational evaluation and validation as selection tests for X-ray screening.
NTIS

X Rays; Security; Explosives Detection; Personnel; Airport Security; Personnel Selection

19980041443 McMullen (John J.) Associates, Inc., Arlington, VA USA

HC-130 Wing Life Raft Replacement Study *Final Report, Dec. 1995 - Jul. 1997*

Scher, Robert M., McMullen (John J.) Associates, Inc., USA; Hatton, Robert E., McMullen (John J.) Associates, Inc., USA; Nov. 1997; 102p; In English

Contract(s)/Grant(s): USCG-D-01-98

Report No.(s): AD-A337264; R/DC-22/97; USCG-D-01-98; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The U.S. Coast Guard (USCG) uses HC-130 aircraft for search and rescue (SAR) and other missions. The aircraft are presently equipped with two to four 20 person inflatable life rafts, stowed in cells in the wings. Similar rafts are also used for SAR missions, droppe d to survivors from low altitude. The existing HC-130 wing life rafts are reversible, and rely primarily on a drogue both to reduce drift rates and provide some increased resistance to lifting out or capsizing. by contrast, several current designs of rafts, many of which are already in service as survival rafts for commercial ships and smaller craft, incorporate fabric ballast bags, attached below the buoyancy tubes. These bags are intended to rapidly flood with seawater once the raft is afloat. A prototype raft intended to serve as a replacement for the existing raft incorporates a ballast system of this type. This report summarizes a general review of the available literature on life raft behavior in extreme wind and sea conditions. It emphasizes the underlying physical mechanisms of life raft capsizing, life raft resistance to capsize, raft drift forces and speeds, potential hazards to life raft occupants as a result of extreme motions and sea loads, including capsize in breaking waves, effects of extreme sea

loads and unusual attitudes on life raft integrity, and stability criteria and related test requirements currently in effect. The report also summarizes observations made during acceptance tests (inflation, righting, and canopy erection tests) of the prototype HC-130 replacement raft, observations and measurements taken during sea-tests for comparison of existing and prototype rafts, and lift-out force tests in accordance with USCG proposed rules.
DTIC
Rescue Operations; Replacing; Prototypes; Rafts; Life Rafts

19980041529 NASA Langley Research Center, Hampton, VA USA
Flight Demonstration of Integrated Airport Surface Movement Technologies
Young, Steven D., NASA Langley Research Center, USA; Jones, Denise R., NASA Langley Research Center, USA; Jan. 1998; 46p; In English
Contract(s)/Grant(s): RTOP 538-04-13-02
Report No.(s): NASA/TM-1998-206283; NAS 1.15:206283; L-17690; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
     This document describes operations associated with a set of flight experiments and demonstrations using a Boeing-757-200 research aircraft as part of low visibility landing and surface operations (LVLASO) research activities. To support this experiment, the B-757 performed flight and taxi operations at the Atlanta Hartsfield International Airport in Atlanta, GA. The test aircraft was equipped with experimental displays that were designed to provide flight crews with sufficient information to enable safe, expedient surface operations in any weather condition down to a runway visual range of 300 feet. In addition to flight deck displays and supporting equipment onboard the B-757, there was also a ground-based component of the system that provided for ground controller inputs and surveillance of airport surface movements. Qualitative and quantitative results are discussed.
Author
Flight Tests; Taxiing; Aircraft Landing; Display Devices

19980045424 Federal Aviation Administration, Aviation Security Human Factors, Atlantic City, NJ USA
Threat Image Projection User Guides for Federal Security Managers, Security Company Managers and Checkpoint Security Supervisors Using EG and G Astrophysics Linescan X-ray Machines *Final Report*
Fobes, J. L., Federal Aviation Administration, USA; Neiderman, E. C., Federal Aviation Administration, USA; Klock, B. A., Federal Aviation Administration, USA; Barrientos, J. M., Federal Aviation Administration, USA; Oct. 1997; 102p; In English
Report No.(s): PB98-126204; DOT/FAA/AR-97/80; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche
     This document provides step-by-step instructions for Federal Security Managers (FSMSs), Security Company Managers (SCMS), and Checkpoint Security Supervisors (CSSs) operating the Threat Image Projection (TIP) system. This system was developed by ED&G Astrophysics for its Linescan X-ray Machines. This document is compressed of two independent user guides. The first explains functions available to FSMs and SCMs.
NTIS
X Ray Imagery; Airports; Security

19980046046

Aircrew schedule generation using repeated matching
Wark, Peter, Univ. of Southern Queensland, Australia; Holt, John; Ronnqvist, Mikael; Ryan, David; European Journal of Operational Research; October 01, 1997; ISSN 0377-2217; Volume 102, no. 1, pp. 21-35; In English; Copyright; Avail: Issuing Activity, FROM
     The consider the Aircrew Scheduling Problem of determining tours of duty (TODs) for aircrews, given a set of sectors (or flights) requiring regular crews. A regular crew consists of two crew members, but by including supplementary crew (a third pilot) on some sectors it is possible to extend duty periods to generate more cost efficient TODs. A related problem is thus to generate TODs for these third pilots, but the sectors requiring a third pilot are not known in advance. to solve these two related problems simultaneously, we apply a heuristic procedure that solves a sequence of matching problems, i.e. a repeated matching algorithm. Numerical results based on the solution of a real problem show that this approach is a valid and efficient method for solving the Aircrew Scheduling Problem, especially when there is the option of using supplementary crew to extend duty periods.
Author (EI)
Flight Crews; Aircraft Pilots; Scheduling; Heuristic Methods; Optimization; Algorithms

19980047450

Aviation's corporate shares

Baldwin, Bernie; Aerospace International; Mar. 1998; ISSN 0305-0831; Volume 25, no. 3, pp. 12-14, 16; In English; Copyright;
Avail: Aeroplus Dispatch

The cost of business aircraft, in terms of purchase price, operation costs, staff, fuel, and other expenses, can be prohibitive
for many companies who would like to be able to use such a facility to ensure that their executives's time is employed to maximum
effectiveness. The NetJets program, created by Executive Jets, may provide an affordable solution. The program provides a time-
share service for business aircraft, a concept termed fractional ownership. Currently, NetJets has over 750 owners in the program,
and the number is growing at a considerable rate. It is believed that fractional ownership will stimulate at least 30 percent growth
in the market for business aircraft production.
AIAA
General Aviation Aircraft; Time Sharing; Aircraft Industry

19980047451

Seeing a safe future

Horne, Mike; Aerospace International; Mar. 1998; ISSN 0305-0831; Volume 25, no. 3, pp. 28-31; In English; Copyright; Avail:
Aeroplus Dispatch

The proposed use of video camera systems on commercial aircraft for both onboard safety and air accident investigation is
examined, with attention given to both technical and economical issues. Based on recent developments in digital video recording
technology, a system is proposed which consists of five internal cockpit mounted cameras and three external cameras, all attached
to the aircraft digital video recorder.
AIAA
Aircraft Safety; Flight Safety; Commercial Aircraft; Video Tape Recorders; Cameras; Onboard Equipment

19980047629

Shephard's police aviation handbook 1998

1998; In English
Report No.(s): ISSN 1364-9698; Copyright; Avail: Aeroplus Dispatch

The 1998 edition of a worldwide guide to police aviation is presented. The topics addressed are: coping with the influx of
cheap military surplus aircraft, specifications of fixed and rotary wing aircraft widely used in police aviation organizations, pay-
load specifications, contact names and fleet details for air support units worldwide, aircraft operating companies which specialize
in supporting police operations, suppliers guide for police air fleets, and a product guide.
AIAA
Police; Handbooks; Civil Aviation; Military Aircraft; Support Systems

19980048381 Civil Aeromedical Inst., Oklahoma City, OK USA

Evaluation of Improved Restraint Systems for Sport Parachutists *Final Report*

Gowdy, R. V., Civil Aeromedical Inst., USA; DeWeese, Richard, Civil Aeromedical Inst., USA; Mar. 1998; 26p; In English
Report No.(s): DOT/FAA/AM-98/11; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

As part of a cooperative project between the Federal Aviation Administration's Civil Aeromedical Institute, the Parachute
Industries Association, and the USA Parachute Association, a series of dynamic impact sled tests were performed to evaluate new
types of restraint systems for sport parachutists. The traditional means of restraining sport parachutists sitting aft-facing on the
floor has been to provide lap belts that are attached to the floor or sidewall of the airplane. The restraint systems evaluated in this
project were designed to route through the parachute harness and attach to the floor. Thus, occupant restraint was provided by
anchoring the parachute harness to the floor by means of the new restraint devices. Seven methods of attaching the restraints to
the parachute harness, which included both single and dual point restraint systems, were dynamically tested. Five models of para-
chute pack/harnesses were included in this project. A VIP 50th percentile anthropomorphic test dummy was modified to simulate
a floor-seated aft-facing parachutist. The impact test severity ranged from 5.5 gs @ 27.8 ft/sec to 9.5 gs @ 32.7 ft/sec. Based on
the results and observations acquired from this series of 12, three of the new restraint methods demonstrated better restraint perfor-
mance than could be expected from that provided by the traditional lap belt method currently recommended.
Author
Parachutes; Dynamic Tests; Impact Tests; Harnesses; Constraints

NASA safety study focuses on tailplane icing stalls

North, David M., USA; Aviation Week & Space Technology; Feb. 09, 1998; ISSN 0005-2175; Volume 14, no. 6, pp. 81-83; In English; Copyright; Avail: Aeroplus Dispatch

Following a history of 16 accidents believed caused by tailplane icing, the Lewis Research Center, at the request of the FAA, initiated a four-year program to define the factors that lead to a tailplane stall and to demonstrate effective tailplane stall reccovery. During the program, NASA pilots and researchers developed a comprehensive database on tailplane aero-performance by the use of wind tunnel testing, numerical simulation, and flight testing. In addition to having a positie effect on tailplane design, the information gained from the NASA research program also could be used to set new FAA certification requirements.
AIAA

Aircraft Icing; Horizontal Tail Surfaces; Aerodynamic Stalling; Flight Safety; NASA Programs

19980048858

Ice accretion prediction on multielement airfoils

Mingione, Giuseppe, CIRA, Italy; Brandi, Vincenzo, CIRA, Italy; Journal of Aircraft; Apr. 1998; ISSN 0021-8669; Volume 35, no. 2, pp. 240-246; In English
Report No.(s): AIAA Paper 97-0177; Copyright; Avail: Aeroplus Dispatch

The aim of this paper is to present the Italian icing computational environment code, I2CE, developed by CIRA, and discuss its evaluation for ice accretion on single and multielement airfoils. The aerodynamic module of the code is based on a potential panel method, whereas the thermodynamic module is based on the classic Messinger model. Different ways to solve the time-dependent ice accretion problem have been taken into account. A comparison between theoretical calculations using multi-time-step, single-time-step, or predictor-corrector procedures and experimental data has been carried out. The effect of the flowfield viscosity on droplet trajectories and the influence of different approaches for the convective heat exchange coefficient calculation have been considered. The influence on the impingement of the actual droplet size distribution has been taken into account and a comparison with a standard median volumetric diameter calculation is presented.
Author (AIAA)

Ice Formation; Aircraft Icing; Airfoil Profiles; Drops (Liquids)

19980048869

Development of the C-17 formation airdrop element geometry

Blake, William B., USAF, Wright Lab., USA; Journal of Aircraft; Apr. 1998; ISSN 0021-8669; Volume 35, no. 2, pp. 175-182; In English; Copyright; Avail: Aeroplus Dispatch

The analysis and tests that established a three-ship C-17 element geometry suitable for formation airdrop operations at night are discussed. The objective is to avoid jumpers encountering vortices generated by aircraft upstream. Candidate formation geometries were judged using a vortex tracking code that estimated the closest lateral proximity between a vortex and a jumper for a given wind condition. The initial formation geometry underwent two changes during the course of the test as a result of the introduction of tolerance boxes for aircraft position and vortex encounters that occurred during mannequin trials. An echelon geometry 6000 ft long and 1500 ft wide was ultimately adopted. In 101 passes over the drop zone, 1349 mannequins and 1251 personnel were dropped from this formation geometry without a vortex encounter.
Author (AIAA)

Airdrops; Vortex Avoidance; C-17 Aircraft; Parachutes

04
AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

19980041328 NERAC, Inc., Tolland, CT USA

NAVSTAR Global Positioning System. (Latest citations from the Aerospace Database)

Feb. 1998; In English
Report No.(s): PB98-852668; Copyright Waived; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The bibliography contains citations concerning the global system of navigation satellites developed to provide immediate and accurate worldwide three-dimensional positioning by air, land, and sea vehicles equipped with appropriate receiving equip-

ment. Technological forecasting, reliability, performance tests, and evaluations are discussed. Developments and applications of the NAVSTAR system are included.(Contains 50-250 citations and includes a subject term index and title list.)
NTIS
Bibliographies; Global Positioning System

19980041472 Naval Postgraduate School, Monterey, CA USA
Comparing Time-Based and Hybrid Time-Based/Frequency Based Multi-Platform Geo-Location Systems
Stewart, Andrew D., Naval Postgraduate School, USA; Sep. 1997; 114p; In English
Report No.(s): AD-A337369; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche
    While time difference of arrival (TDOA) information is sufficient to passively solve for the location of a radio frequency transmitter, frequency difference of arrival (FDOA) information may be added to the TDOA information to solve for both the position and velocity of the transmitter. This analysis implements a stochastic discrete event simulation, written in Java, to compare and stochastically describe, under a variety of conditions, the differences between a mixed TDOA/FDOA Multi-platform Global Positioning System (GPS) Assisted Geo-location System and that of the same system which uses TDOA information only. The presented analysis compares both solution types for two- and three-dimensional fixes across: various measurement error distributions and correlation values, sensor network geometry, and sensor platform selection. The simulation results show first order stochastic dominance in the accuracy of the TDOA/FDOA solution in the two-dimensional scenarios. In the three-dimensional scenarios, sensor network to target geometry dominates both solutions' accuracy. While solution accuracy is used as the primary method of effectiveness, the distribution of each solution's uncertainty is also compared. Finally, the simulation itself remains a useful tool for further system design experimentation, performance indication, and as a means to describe system capabilities to the war fighter.
DTIC
Computerized Simulation; Global Positioning System; Radio Frequencies

19980041524 Naval Postgraduate School, Monterey, CA USA
Design of an Algorithm for Minimizing LORAN-C Time Difference Error
France, Frederick M., Jr., Naval Postgraduate School, USA; Sep. 1997; 216p; In English
Report No.(s): AD-A337399; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche
    The USA Coast Guard (USCG) is in the process of upgrading the hardware of the LORAN-C Radio Navigation System Control System. As part of this effort, the Computer-Assisted LORAN-C Controller (CALOC) is also in need of improvement. CALOC performs four tasks: abnormality detection, time difference control, record keeping, and blink control. The work reported in this thesis focuses on time difference control. In many instances, does not accurately control the time difference error within the established USCG control procedures. Two new algorithms are proposed here to control TDE more effectively: a Proportional Integral Derivative (PID) controller and a Kalman filter. Actual TDE data recorded at three different master stations covering five LORAN-C chains is used to evaluate the performance of the proposed controllers. The PID controller shows a substantial improvement in control compared to CALOC, and the Kalman filter exhibits even better performance, based on preliminary results. This improvement in control correlates directly with an increase in both predictable accuracy and repeatable accuracy.
DTIC
Algorithms; Hardware; Error Analysis; LORAN C; Time Dependence

19980046969
Three-dimensional azimuth of GPS vector
Burkholder, Earl F., Global COGO, Inc., USA; Journal of Surveying Engineering; November, 1997; ISSN 0733-9453; Volume 123, no. 4, pp. 139-146; In English; Copyright; Avail: Issuing Activity
    The azimuth of a line is a 2-dimensional (2D) phenomenon whose meaning is determined by its circumstance. With the advent of global positioning system (GPS) surveying and making spatial data computations in a 3D environment, it is convenient to compute azimuth as the arctan (Delta e/ Delta n) where Delta e and Delta n represent local geodetic horizon components of a 3D vector (GPS baseline) defined by Delta X/ Delta Y/ Delta Z geocentric coordinate differences. This paper describes the geometrical characteristics of such an azimuth, proposes it to be called the 3D azimuth, and shows how the 3D azimuth is related to a geodetic azimuth.
Author (EI)
Geocentric Coordinates; Global Positioning System; Surveys; Geodesy; Vectors (Mathematics)

Calling home with Satcom

Marsh, George; Defence Helicopter; Mar. 1998; ISSN 0963-116X; Volume 17, no. 1, pp. 21, 22, 24, 25; In English; Copyright; Avail: Aeroplus Dispatch

A survey is made of prospective use by military helicopters of comsats from the Inmarsat consortium, whose Inmarsat 3 satellites in GEO are eight times more powerful than their predecessors. The great spot-beam coverage of this satellite fleet allows the communications equipment carried on each aircraft to be less powerful and therefore more compact, robust, and affordable; these are critical considerations for military helicopters.

AIAA

Satellite Communication; Military Helicopters; Data Links; Flight Crews; Aircraft Maneuvers

Recent developments in aircraft intercommunications systems

Ammons, Mike, SCI Systems, Inc., USA; Neely, Curtis, SCI Systems, Inc., USA; 1997; In English; Copyright; Avail: Aeroplus Dispatch

This paper provides a tutorial on the functional characteristics of a present-day aircraft intercommunication system and addresses the new capabilities that are being developed to extend its usefulness to the crew members. A typical multistation ICS utilizing digital audio technology is described in detail from a functional perspective. The topics of discussion include the system components, aircraft interfaces, operational features, modes of operation, synthesized warning and caution advisories, microphone activation control, and emergency operations. System components include a central communications switching unit and remote operator control stations. The central communications unit controls overall system operation and provides the interface to the aircraft communications system. The control stations contain the headset/microphone interface and provide the operator an intercommunications control panel. The application of digital signal processors to these system components has greatly expanded the ICS capabilities and improved their performance. Next generation systems will contain features to improve the situational awareness of the aircrew, reduce the effects of acoustic noise, and improve the overall clarity of voice communications.
Author (AIAA)

Aircraft Communication; Flight Crews; Audio Signals; Digital Techniques; Voice Communication

Eyes of the fleet

Donaldson, Peter; Defence Helicopter; Mar. 1998; ISSN 0963-116X; Volume 17, no. 1, pp. 30-32, 34, 36, 37; In English; Copyright; Avail: Aeroplus Dispatch

An account is given of state-of-the-art radars that can be fitted to the marine helicopters on which naval forces rely for early detection of submarine periscopes and sea-skimming cruise missiles, as far from capital ships as possible. Attention is given to operating frequency, antenna design, and other variables affecting the specific performance of such surveillance radars.

AIAA

Military Helicopters; Airborne Radar; Helicopter Design; Navy; Fixed Wings; Radar Targets

The future is synthetic

Waddington, Sara; Unmanned Vehicles; Apr. 1998; ISSN 1351-3478; Volume 3,, no. 1, pp. 6-8; In English; Copyright; Avail: Aeroplus Dispatch

Unmanned Aerial Vehicles (UAVs) equipped with SAR will increasingly furnish field commanders with high-resolution reconnaissance and targeting imagery irrespective of weather or cloud cover. SAR uses the aircraft's own flight path to simulate an extremely large antenna, using the Doppler history of radar signal returns to construct a high-resolution image. The faster the UAV platform, the more pronounced the Doppler shifts and the finer the range resolution obtained. A survey is presented of this technology.

AIAA

Military Aircraft; Synthetic Aperture Radar; Pilotless Aircraft; Aircraft Detection

19980048278

Noncooperative target sensor registration in a multiple-hypothesis tracking architecture

Lobbia, Robert, Orincon Corp., USA; Frangione, Ellen, Orincon Corp., USA; Owen, Mark, Orincon Corp., USA; 1997, pp. 269-277; In English

In a distributed track-level level fusion system, it is a well-known fact that successful fusion of tracks from offboard sources requires that these tracks do not contain underlying biases or offsets. Unfortunately, this lack of bias or offset is often not the case, because the offboard tracking system references its tracks to a coordinate system that is offset and misaligned with respect to truth due to navigational drift and sensor misalignment. In this paper, we present a technical approach for both detecting and correcting for these biases in a noncooperative target sense. Furthermore, the algorithms are configured to operate in a multiple-hypothesis tracking environment. These algorithms have been implemented in a simulated air threat environment, and performance improvements have been noted of up to an order of magnitude in target/track miss distance.

Author (AIAA)

Multiple Target Tracking; Multisensor Fusion; Miss Distance

19980048281

Clustering approach to the multitarget multisensor tracking problem

Nabaa, Nassib, Texas, Univ., Austin, USA; Bishop, Robert H., Texas, Univ., Austin; 1997, pp. 226-237; In English; Copyright; Avail: Aeroplus Dispatch

In a multitarget environment, tracking systems must include methods for associating measurements to targets. The complexity of that task is compounded when data from multiple sensors is available. This paper presents a clustering approach to the multitarget multisensor tracking problem. The measurement set is partitioned into equivalence classes (clusters) and the data association problem is redefined to be one of associating the cluster centers and the tracks, resulting in a significant reduction in the size of the association problem. Track termination and track initiation are part of system design, therefore allowing the designed system to be tested on elaborate multitarget tracking scenarios involving an unknown and changing number of real aircraft trajectories. Methods for evaluating the performance of the tracking system, as well as the clustering algorithms are introduced. An equivalence relation clustering algorithm is derived and compared by Monte-Carlo simulations to the subtractive clustering algorithm. The tracking system is shown to effectively track seven crossing aircraft trajectories of different duration, in the presence of clutter. Track maintenance is performed by extended Kalman filters.

Author (AIAA)

Aircraft Detection; Multiple Target Tracking; Multisensor Fusion; Cluster Analysis; Flight Paths

19980048314

Large scale air traffic surveillance using an IMM estimator with assignment

Wang, H., Connecticut, Univ., Storrs, USA; Kirubarajan, T., Connecticut, Univ., Storrs; Li, Y., Connecticut, Univ., Storrs; Bar-Shalom, Y., Connecticut, Univ., Storrs; 1997, pp. 376-387; In English

The authors present the development and implementation of a multisensor-multitarget tracking algorithm for large scale air traffic surveillance based on the IMM state estimator combined with a two-dimensional assignment for data association. The algorithm can be used to track a large number of targets from measurements obtained with a large number of radars. The use of the algorithm is illustrated on measurements obtained from five FAA radars, which are asynchronous, heterogeneous and geographically distributed over a large area. Both secondary radar data (beacon returns from cooperative targets) as well as primary radar data (skin returns from noncooperative targets) are used. The target IDs from the beacon returns are not used in the data association. The surveillance region includes about 800 targets that exhibit different types of motion. The performance of the IMM estimator is compared with that of the Kalman filter. A number of performance measures that can be used on real data without knowledge of the ground truth are presented for this purpose. It is shown that the IMM estimator performs better than the Kalman filter. The advantage of fusing multisensor data is quantified. It is also shown that the computational requirements in the multisensor case are lower than in single sensor case.

Author (AIAA)

Surveillance Radar; Multiple Target Tracking; Multisensor Fusion; Radar Measurement; Kalman Filters

Includes aircraft simulation technology.

19980041322 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA

Multiple Model Adaptive Estimation and Control Redistribution Performance on the Vista F-16 During Partial Actuator Impairments, Volume 3

Clark, Curtis S., Air Force Inst. of Tech., USA; Dec. 1997; 219p; In English

Report No.(s): AD-A337185; AFIT/GE/ENG/97D-23-VOL-3; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

Multiple Model Adaptive Estimation with Control Reconfiguration (MMAE/CR) capability to estimate and compensate for partial actuator failures, or 'impairments' is investigated using the high fidelity, nonlinear, six degree of freedom, VISTA F-16 simulation which currently resides on the Simulation Rapid-Prototyping Facility (SRF). After developing a model for inserting partial actuator impairments into the VISTA F-16 truth model, research begins with a battery of single actuator impairment tests. This stage of research explores the capability of the existing MMAE algorithm to estimate single, partial actuator impairments, and helps to define refinements and expansions needed in the MMAE algorithm for the second phase of research: the detection and estimation of dual, total and partial actuator impairments. It is seen from the first stage of research that, while MMAE is able to estimate partial impairments, there are refinements needed, such as 'probability smoothing and quantization', to compensate for the quality of MMAE probability data and to provide a better, more stable estimate value to the Control Reconfiguration module. The Kalman filters and the dual, partial failure filter banks necessary for the detection of dual, partial actuator impairments are also defined as a result of the single impairment tests. Fifteen more banks of 'partial first failure' Kalman filters are added to the existing MMAE algorithm, as well as the 'bank swapping' logic necessary to transition to them. Once the revised and expanded MMAE/CR algorithm is ready, research begins on dual combinations of total and partial actuator impairments. While results of these tests (for other than total impairments) are not as good as originally hoped or expected, the potential for better performance is evident.

DTIC

Aircraft Detection; Adaptive Control; Degrees of Freedom; Simulation; Flight Control; Control Systems Design

19980041425 Massachusetts Inst. of Tech., Lincoln Lab., Lexington, MA USA

Evaluation of Boeing 747-400 Performance during ATC-Directed Breakouts on Final Approach

Hollister, K. M., Massachusetts Inst. of Tech., USA; Rhoades, A. S., Massachusetts Inst. of Tech., USA; Lind, A. T., Massachusetts Inst. of Tech., USA; Jan. 07, 1998; 184p; In English

Report No.(s): PB98-123524; ATC-263; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

The effects of three different levels of pilot training on the breakout response of pilots at the Boeing 747-400 aircraft were studied. The study examined responses during ATC-directed breakouts on final approach and was conducted in three studied. The study examined responses during ATC-directed breakouts on final approach and was conducted in three phases. Phase 1 tested performance during manual and autopilot-coupled approaches given current procedures and pilot training. Phase 2 tested the effect of increased pilot situational awareness and proposed ATC breakout phraseology on breakouts during manual and autopilot-coupled approaches. Phase 3 tested the effect of two B747-400-specific breakout procedures on breakouts during autopilot-coupled approaches. Pilot preferences regarding procedures and the tested training materials were also solicited.

NTIS

Pilot Training; Boeing 747 Aircraft; Approach; Education; Automatic Pilots

19980041460 RAND Corp., Santa Monica, CA USA

The Predator ACTD; A Case Study for Transition Planning to the Formal Acquisition Process

Thirtle, Michael R., RAND Corp., USA; Johnson, Robert V., RAND Corp., USA; Birkler, John L., RAND Corp., USA; Jan. 1997; 107p; In English

Contract(s)/Grant(s): DASW01-95-C-0059

Report No.(s): AD-A337401; RAND/MR-899-0SD; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

In July 1995, a new endurance unmanned aerial vehicle (UAV) flew over Bosnia to surveil and provide all-weather reconnaissance and image-gathering in an operational (i.e., conflict) environment. Representing a new capability for the Department of Defense (DoD), this UAV represented, above all, a departure from DoD's usual way of doing acquisition business. The study documented in this report was completed in support of RAND research on Advanced Concept Technology Demonstration (ACTD) programs for the Office of the Secretary of Defense. The effort was conducted from July until December 1996 and documents research on the Medium Altitude Endurance (MAE) Unmanned Aerial Vehicle ACTD program, also known as the Predator

UAV. Specifically, RAND was tasked to examine two questions: (1) what were the overarching lessons learned from the Predator ACTD? and (2) Which lessons can be generalized and applied to other ACTD programs? In this analysis, we closely detail the Predator ACTD and also document the important demonstration and transition issues from the project that can be applied to other ACTDs. The intent of this work is to improve the ACTD process and the transition of ACTDs to formal acquisition programs. This report should be of interest to those involved in acquisition, program offices, and ACTD programs.
DTIC
Planing; Acquisition; Examination; Pilotless Aircraft

19980044583
Elastic-plastic finite element alternating method (EPFEAM) and the prediction of fracture under WFD conditions in aircraft structures. Part III: Computational predictions of the NIST multiple site damage experimental results
Wang, L., Georgia Inst. of Technology, USA; Brust, F. W.; Atluri, S. N.; Computational Mechanics; August, 1997; ISSN 0178-7675; Volume 20, no. 3, pp. 199-212; In English; Copyright; Avail: Issuing Activity

The elastic-plastic finite element alternating method (EPFEAM) and the T*-integral fracture mechanics parameter were used to predict the residual strength of aircraft panels with multiple-site damage. These predictions were compared with the experimental data and validated the model for computing the residual strength under wide-spread-fatigue damage conditions.
EI
Aircraft Structures; Finite Element Method; Fracture Mechanics; Mathematical Models; Elastoplasticity; Panels

19980046112
Aluminum-lithium alloys in helicopters
Smith, Alan F., GKN Westland Helicopters Ltd., UK; Advanced Materials & Processes; October, 1997; ISSN 0882-7958; Volume 152, no. 4, pp. 41-43; In English; Copyright; Avail: Issuing Activity

Aluminum-lithium alloys are now widely applied in helicopters such as the EH101 helicopter. In this helicopter, aluminum-lithium alloys account for over 90% of all the aluminum alloys in the airframe. Some of the alloys commonly used include AA 8090, AA 2090 and AA 5091.
EI
Aluminum Alloys; Aluminum-Lithium Alloys; Lithium Alloys; Modulus of Elasticity; Helicopters; Powder Metallurgy; Airframes

19980046608
Mechanical properties of aircraft materials subjected to long periods of service usage
Scheuring, J. N., Purdue Univ., USA; Grandt, A. F. , Jr.; Journal of Engineering Materials and Technology, Transactions of the ASME; October, 1997; ISSN 0094-4289; Volume 119, no. 4, pp. 380-386; In English; Copyright; Avail: Issuing Activity

This paper evaluates changes in the behavior of aircraft materials which result from aging and/or corrosion that occurs during long periods of service usage. The primary objective was to determine whether damage tolerant analyses for older aircraft should employ updated properties that more accurately represent the current state of the material, or if the virgin material properties continue to properly characterize the aged/corroded alloy. Specifically, tensile stress-strain curves, cyclic stress life (SN) tests, and fatigue crack growth tests were used to characterize the 'aged aircraft' material. These properties were compared with handbook properties for virgin material of the same pedigree. The aluminum alloys tested were obtained from fuselage and wing panels of retired KC-135 aircraft. Computer controlled tests were conducted using specimens machined from the retired aircraft components. Different configurations were used to observe the effects of aging and/or corrosion on material behavior. In the crack growth specimens, various levels of corrosion were observed, thus the crack growth rates could be categorized as a function of the level of corrosion present. The SN and da/dN- Delta K curves for the 'aged' only materials were compared with the fatigue properties of virgin material of the same alloy. Similar comparisons were performed for the tensile stress-strain properties.
Author (EI)
Crack Propagation; Fatigue (Materials); Life (Durability); Mechanical Properties; Numerical Control; Stress-Strain Relationships; Tensile Stress; Aircraft Construction Materials; Aging (Materials); Corrosion

19980047113 Applied Research Associates, Inc., Raleigh, NC USA
Interface-Driven Multidisciplinary Design of Large-Scale Aircraft Structures *Final Report, 2 Dec. 1995 - 1 Dec. 1996*
Oakley, David R., Applied Research Associates, Inc., USA; Rhodes, Graham S., Applied Research Associates, Inc., USA; Kruger, Lonny B., Applied Research Associates, Inc., USA; Feb. 1997; 48p; In English
Contract(s)/Grant(s): F33615-96-C-3206; AF Proj 3005
Report No.(s): WL-TR-97-3078; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report presents Phase 1 research to develop an Interface-Driven Design Manager (IDM) that greatly reduces the design cycle time for affordable composite aircraft. The IDM represents a first attempt to fully integrate powerful new interface element and 3-D interactive graphics technology into a single design environment to automate the assembly and analysis of multicomponent global- local models for faster, more accurate composite airframe design. These emerging technologies have the potential for making multidisciplinary design optimization of large-scale composite structures practical and for providing new levels of design automation that are currently not possible. The IDM provides a graphical environment for rapidly assembling global-local models, as well as other complex Multicomponent airframe models, from pre-meshed 'stock' components stored in a relational database, without concern for mesh compatibility. The IDM enables the designer to automatically insert components or regions with a highly refined mesh into the coarse mesh of a global model using, interface elements. This provides two substantial benefits: (1) detailed local models can be used without remeshing the entire structure thereby substantially reducing the associated engineering, cost; and (2) higher accuracy can be achieved in critical regions without substantial increases in computational cost. Both of these benefits make it practical to use higher-fidelity models earlier in the design cycle so that primary structures which are truly optimized for the application of affordable composites are achieved.
Author
Aircraft Structures; Aircraft Design; Airframes; Multidisciplinary Design Optimization; Relational Data Bases

19980047144

Aluminum alloys for aerostructures

Staley, James T., Alcoa Technical Cent., USA; Liu, John; Hunt, Warren H. , Jr.; Advanced Materials & Processes; October, 1997; ISSN 0882-7958; Volume 152, no. 4, pp. 17-20; In English; Copyright; Avail: Issuing Activity

Demands on the airframe industry have always moved in the direction of lower weight, higher damage tolerance, and longer-term durability. Today's focus is on materials that can help achieve low-cost manufacturing without sacrificing performance. This article describes the development of high-strength aluminum alloy materials that have satisfied past and current requirements, and identifies possible alumina-intensive approaches that combine alternate design concepts and emerging materials technologies for low-cost, low-weight, damage-tolerant, and durable airframe structures of the future.
EI
Aircraft Structures; Aluminum Alloys; Fatigue (Materials); Fracture Strength; Durability; Accident Prevention; Airframes

19980047504

The shape of wings to come

Figgen, Achim, Germany; AeroSpace; Feb. 1998; ISSN 0949-7064, no. 1, pp. 20-24; In English; Copyright; Avail: Aeroplus Dispatch

Constant improvements in efficiency and reliability are needed if the Airbus is to remain competitive in the future. One of the most important objectives is to reduce the fuel consumption. Daimler Benz Aerospace is assuming that fuel savings of up to 36 percent can be achieved over the next 20 years by improving the aerodynamics of aircraft. Here, attention is given to an adaptive wing project which investigates the possibility of adapting the wing geometry to the prevailing conditions (weight, attitude, airspeed) and reducing frictional losses and lift-depending drag by controlling airflow over the wing surface and counteracting any undesirable vortices. Together these measures should improve the performance of an aircraft, thus allowing for greater flexibility of operations.
AIAA
Wing Profiles; European Airbus

19980047758

A real-time mission performance computation approach for V-22 Osprey

Lu, Jim, Boeing Helicopters, USA; Goldman, Steve, Boeing Helicopters, USA; 1997; In English; Copyright; Avail: Aeroplus Dispatch

This paper outlines the approach for V22 Mission Performance Computations algorithm development and implementation. Algorithm drivers considered throughout the development process included the throughput and memory restrictions of a real-time embedded environment, the complexity of modeling a turboshaft propulsion system, variable nacelle angle flight, accuracy goals, and mission specific leg properties. A generalized curve fit approach is used to generate engine performance for maximum (MAX) power, intermediate rated power (IRP), and maximum continuous power (MCP). The same approach is used to generate power

required, shaft horsepower (SHP), thrust horsepower THP, fuel flow rate, 99 percent best range true airspeed, and conversion mode SHP required.
Author (AIAA)
Real Time Operation; V-22 Aircraft; Turboshafts; Engine Tests; Propulsion System Performance

19980048089
Analytical methodology for predicting widespread fatigue damage onset in fuselage structure
Harris, Charles E., NASA Langley Research Center, USA; Newman, James C., Jr., NASA Langley Research Center, USA; Piascik, Robert S., NASA Langley Research Center, USA; Starnes, James H., Jr., NASA Langley Research Center, USA; Journal of Aircraft; Apr. 1998; ISSN 0021-8669; Volume 35, no. 2, pp. 307-317; In English; Copyright; Avail: Aeroplus Dispatch

A comprehensive analytical methodology has been developed for predicting the onset of widespread fatigue damage (WFD) in fuselage structure. The determination of the number of flights and operational hours of aircraft service life that are related to the onset of WFD includes analyses for crack initiation, fatigue crack growth, and residual strength. Therefore, the computational capability required to predict analytically the onset of WFD must be able to represent a wide range of crack sizes, from the material (microscale) level to the global (structural-scale) level. The results of carefully conducted teardown examinations of aircraft components indicate that fatigue crack behavior can be represented conveniently by the following three analysis scales: 1) small three-dimensional cracks at the microscale level, 2) through-the-thickness two-dimensional cracks at the local structural level, and 3) long cracks at the global structural level. The computational requirements for each of these three analysis scales are described in this paper.
Author (AIAA)
Fatigue (Materials); Damage; Fuselages; Crack Initiation; Crack Propagation; Residual Strength

19980048173
Parametric analysis of the lower eigenmodes and eigenfrequencies of structural vibration *Parametricheskij analiz nizshikh sobstvennykh form i chastot kolebanij konstruktsii*
Garifullin, M. F., Kazanskij Gosudarstvennyj Tekhnicheskij Univ.-Kazanskij Aviatsionnyj Inst., Russia; Aviatsionnaya Tekhnika; 1997; ISSN 0579-2975, no. 3, pp. 84-87; In Russian; Copyright; Avail: Aeroplus Dispatch

A method is proposed for calculating the lower eigenmodes and eigenfrequencies of structural vibration. The method makes it possible to reduce the computational effort required for the parametric analysis of aircraft structures. Calculation results are presented to illustrate the capabilities of the method.
AIAA
Dynamic Structural Analysis; Structural Vibration; Resonant Frequencies; Aircraft Structures

19980048174
Mathematical modeling of the shape and cut pattern of flexible wings *Matematicheskoe modelirovanie formy i kroya myagkikh kryl'ev*
Gimadiev, R. Sh., RAN, Inst. Mekhaniki i Mashinostroeniya, Russia; Aviatsionnaya Tekhnika; 1997; ISSN 0579-2975, no. 3, pp. 79-83; In Russian; Copyright; Avail: Aeroplus Dispatch

A mathematical model is presented which describes the three-dimensional shape of a two-shell flexible wing, the choice of the sling system, and design of the wing section pattern. In particular, attention is given to the planform geometry of the wing, geometry of the wing ribs, and cut patterns for the lower and upper wing surfaces. The maximum calculation errors in flexible wing design are estimated.
AIAA
Aircraft Design; Flexible Wings; Wing Profiles; Surface Geometry; Wing Planforms

19980048188
Efficiency of a prolonged high-velocity atmospheric flight *Ob ehffektivnosti dlitel'nogo poleta v atmosfere s bol'shimi skorostyami*
Luk'yanov, G. A., Baltijskij Gosudarstvennyj Tekhnicheskij Univ., Russia; Aviatsionnaya Tekhnika; 1997; ISSN 0579-2975, no. 3, pp. 3-8; In Russian; Copyright; Avail: Aeroplus Dispatch

Results of an analysis of the efficiency of the atmospheric flight of an aircraft with a jet engine are presented for a wide range of velocities. It is shown that the principal efficiency characteristics decrease rapidly with the increasing supersonic speed (e.g.,

the maximum flight range decreases while specific energy consumption increases). A comparison is made between the parameters of aircraft with jet engines operating on kerosene and on hydrogen, respectively.

AIAA

Jet Engines; Aircraft Fuels; Supersonic Flight; Flight Characteristics; Energy Consumption

19980048195

Next-gen Unmanned Aerial Vehicles ready for remote military/police imaging and more

Hamit, Francis, USA; Advanced Imaging; Jan. 1998; ISSN 1042-0711; Volume 13, no. 1, pp. 50-52; In English; Copyright; Avail: Aeroplus Dispatch

An account is given of recent advancements in the use of UAVs as high performance sensor platforms for high endurance military and police surveillance missions. Attention is given to such long range/high endurance flying platforms as the SAR-carrying Global Hawk, Predator, Outrider, and highly stealthy Darkstar UAVs.

AIAA

Pilotless Aircraft; Flight Vehicles; Military Aircraft; Police; Aircraft Design

19980048219

Load measurements on the leading-edge extension, wing, and body of an F/A-18

Lee, B. H. K., National Research Council of Canada, Ottawa, Canada; Marineau-Mes, S., Ottawa, Univ., Canada; Journal of Aircraft; Apr. 1998; ISSN 0021-8669; Volume 35, no. 2, pp. 295-300; In English; Copyright; Avail: Aeroplus Dispatch

The pressure difference across the wing and leading-edge extension (LEX) of a rigid six percent scale model of an F/A-18 was measured, and the integrated static and rms loads were computed. The total loads on the aircraft were obtained using a sting-mounted balance from which the body loads can be deduced by subtracting the LEX and wing loads. The effects of Mach number and angle of attack were analyzed and results for M = 0.25, 0.6, and 0.8 at alpha = 20-35 deg are presented. The effectiveness of the LEX as a highlift device is demonstrated by comparing the individual lift contributions from the wing and LEX at different angles of attack and Mach numbers. It is shown that the LEX vortex can generate large nonlinear static lift while inducing high unsteady lift on the aircraft.

Author (AIAA)

Leading Edges; F-18 Aircraft; Aerodynamic Loads; Blowdown Wind Tunnels; Unsteady Aerodynamics

19980048220

Aeroelastic computations on wing-body-control configurations on parallel computers

Byun, Chansup, NASA Ames Research Center, USA; Guruswamy, Guru P., NASA Ames Research Center, USA; Journal of Aircraft; Apr. 1998; ISSN 0021-8669; Volume 35, no. 2, pp. 288-294; In English

Contract(s)/Grant(s): NAS2-14109; Copyright; Avail: Aeroplus Dispatch

A multizonal capability for aeroelastic computation of complex geometries has been implemented in ENSAERO, an aeroelastic analysis code with Euler/Navier-Stokes flow solver, on the IBM SP2 parallel computer. The discipline parallelization is achieved by distributing the fluid, structure, and control domains onto different groups of computational nodes. The fluid domain is further parallelized based on the multizonal method. The coupling between the fluids and structures is obtained by exchanging the interface boundary data at every iteration by using the explicit message passing interface standard library. The performance of the current implementation shows that about 12 computational nodes of the SP2 computer are equivalent to the speed of a single C90 processor. For demonstration purposes, static aeroelastic computations coupled with control surfaces are made for an arrow wing-body-control configuration in the transonic flow regime. Computed pressure coefficients for a rigid configuration were compared with the wind-tunnel experiment. The two results show good agreement. Steady aeroelastic simulations are made with and without control surface deflections. The static aeroelastic simulations show that the effect of flexibility is significant on aerodynamic coefficients. It is noted that the flexible wing lowered the sectional lifts compared to the rigid wing. This procedure can be utilized for the fast computational solution of large-scale wind-tunnel models and real configurations that inevitably deform under aerodynamic loads.

Author (AIAA)

Aeroelasticity; Body-Wing Configurations; Parallel Computers; Navier-Stokes Equation; Wind Tunnel Tests; Transonic Flow

19980048242

Aeroelastic effects on the weight of an aircraft in the pre-design phase

Kelm, Roland, Daimler-Benz Aerospace Airbus GmbH, Germany; Grabietz, Michael, Daimler-Benz Aerospace Airbus GmbH, Hamburg; Ingenieurbuero Michael Grabietz, Germany; May 1997; In English

Report No.(s): SAWE Paper 2407; Copyright; Avail: Aeroplus Dispatch

This paper describes the method and process for the calculation of aeroelastic effects on the weight of an aircraft. A method appropriate for the inclusion of aeroelastic effects at the very beginning of a new aircraft project is presented. Even if only a simple three-sided view with a proper definition of the wing geometry is available, first calculations can be performed. The software-tool FAME-W, which is used in the future projects office at Daimler-Benz Aerospace AIRBUS in Hamburg, is detailed with emphasis on the multidisciplinary character of the computational approach. The results show the effects of aeroelasticity, particularly on the wing and tailplane weight. A procedure for the calculation of the stiffness and mass distribution is presented. The influence of geometric parameters like sweep angle and aspect ratio is identified. The effectiveness of a maneuver load control system including all relevant flexibility effects for a trimmed aircraft is shown. The redistribution of the lift and pitching moment, and the effect on the L/D ratio during a flight mission are pointed out. A precise calculation of the L/D ratio of a new aircraft is the basis for the assessment of its viability. The paper also demonstrates the strong influence of aeroelasticity in the pre-design phase beginning with minimum information and finishing with detailed knowledge about the new aircraft.
Author (AIAA)
Aircraft Design; Aeroelasticity; Structural Weight; Vibration Effects; Wing Profiles

19980048245

Evaluation of weight during aircraft design - An integrated approach

Frank, Michael D., Boeing Commercial Airplane Group, USA; May 1997; In English
Report No.(s): SAWE Paper 2391; Copyright; Avail: Aeroplus Dispatch

For an aircraft to be successful in the marketplace, design decisions must consider all impacts on the customer. of particular importance is the decision with regard to potential weight increases. Since weight affects performance and thus the customer's 'bottom line', weight changes should be evaluated with a 'dollar-based' metric. This paper outlines a framework for evaluating weight during detail design using a hypothetical study aircraft. The approach explicitly links the decisions of customers and original equipment manufacturers so that effects of a weight change can be better understood. Airline operations are emphasized, but the approach can be extended to other uses. Both aircraft performance and data provided are hypothetical and do not reflect current or future aircraft.
Author (AIAA)
Aircraft Design; Weight Analysis; Systems Integration; Airline Operations; Aircraft Performance

19980048246

Booster alignment for an aerial vehicle ground launch

McGill, Andrew, Lockheed Martin Astronautics, USA; May 1997; In English
Report No.(s): SAWE Paper 2387; Copyright; Avail: Aeroplus Dispatch

The successful ground launch of an aerial vehicle depends on proper booster alignment. A misalignment causes an undesirable rotation during the boost phase of flight and causes a crash. Mass properties engineering provides component weights and centers of gravity that are required to determine the booster alignment angle. The booster rocket is aligned to balance the thrusting forces about the center of gravity of the combined vehicle and rocket. However, the combined center of gravity is a function of this booster alignment. This paper derives the theoretical solution for determining the correct booster alignment angle. The solution to the test case for an inert vehicle is linear and a function of the aircraft configuration. The solution for a real aircraft is a second order polynomial solved by a quadratic equation. Discussion of practical considerations follows the derivation of the theoretical solution. Booster gimballing or thrust vectoring control would provide more flexibility to the problem of booster alignment.
Author (AIAA)
Flight Vehicles; Mass Distribution; Structural Weight; Booster Rockets; Aircraft Configurations; Thrust Vector Control

19980048247

The V/STOL propulsion weight fraction revisited

Sanders, Karl L., USA; May 1997; In English
Report No.(s): SAWE Paper 2383; Copyright; Avail: Aeroplus Dispatch

In light of the current JSF (Joint Strike Fighter) prototype program, the causes for the 40 year long cyclical and stymied efforts to develop the fixed-wing high-speed powered-lift V/STOL aircraft are briefly reviewed. Four imperative design objectives are suggested and defined. Two of these are: (1) a benign exhaust footprint and (2) a low propulsion weight fraction of take-off weight. The propulsion group weight fractions of 45 designs, encompassing 10 powered-lift concepts, are plotted vs. conception year. It is shown that airframe weight savings have the potential to offset propulsion weight increments. Cruise engine weight is the largest

part of total propulsion weight, and bypass ratio one of the most important cycle variables. Therefore, a correlation of engine thrust/weight ratio with bypass ratio for 17 engines was made to trend the upper and lower bounds of the scatter band.
Author (AIAA)

V/STOL Aircraft; Prototypes; Fixed Wings; Structural Weight

19980048249

The impact of weight analysis and control on Joint Strike Fighter development

Jackson, S. K., Jr., Lockheed Martin Tactical Aircraft Systems, USA; May 1997; In English

Report No.(s): SAWE Paper 2382; Copyright; Avail: Aeroplus Dispatch

The Joint Strike Fighter (JSF) program as currently planned will be the dominant new fighter program for the next two decades. Several features of the program make weight predictions and weight control particularly vital to program success. These factors include the fact that the aircraft must meet differing requirements of at least four different services, must adhere to strict cost/affordability constraints, and in one version must meet demanding Short Takeoff/Vertical Landing (STOVL) requirements. The impact of these factors on weight analysis and control methods will be described from a Chief Engineer's perspective, beginning with a few historical observations and ending with recommendations and challenges to the weight engineering community.
Author (AIAA)

Aircraft Design; Weight Analysis; Aircraft Performance; STOVL Aircraft

19980048250

Considerations in developing reasonability checks and preliminary estimating methods

Scott, Paul W., McDonnell Douglas Corp., USA; May 1997; In English

Report No.(s): SAWE Paper 2381; Copyright; Avail: Aeroplus Dispatch

Rapid Estimation Methods (REMs) are proposed as a way to resolve the conflict between achieving reasonable accuracy in advanced design weight engineering and the obligation of meeting a tight schedule. REMs must satisfy several criteria: they must be simple and fast, provide reasonable accuracy, incorporate the major parameters that influence weight, and, where possible, be intuitively logical. The validity of the approach proposed here is demonstrated for several case studies, including fuselage wetter area estimation/checking, moment of inertia estimation/checking, and aircraft empty weight estimation/checking.
AIAA

Aircraft Performance; Moments of Inertia; Fuselages; Pitching Moments

19980048251

The K-MAX Helicopter - A unique lifting efficiency

Haliscak, George W., Kaman Aerospace Corp., USA; May 1997; In English

Report No.(s): SAWE Paper 2373; Copyright; Avail: Aeroplus Dispatch

The Kaman K-1200 (K-MAX) Helicopter was certified in August 1994. It is the only FAA certified aircraft designed, built, tested, and operated for the continuous repetitive external load mission. It is a single-seat, single engine and transmission, composite dual-rotor aircraft. The aircraft design is optimized around the pilot and the external load attaching point (the hook). The cockpit and airframe are configured for maximum use of vertical reference flying (directly viewing the load from the cockpit) and minimizing pilot workload. The hook, supporting structure, and dynamic components have been tested to withstand daily, continuous, repetitive maximum load lifting throughout the life of the airframe. Operations performed to date include: logging, firefighting, seismic exploration, construction, agricultural, resupply via external load, and emergency rescue. The heaviest usage is logging followed by construction and firefighting. Aircraft have been operating in the U.S., Canada, Japan, Switzerland, Germany, Liechtenstein, and Bolivia in commercial applications, and at sea for the U.S. Navy. The K-MAX Helicopter is demonstrating a unique lifting efficiency in the commercial and military utility helicopter markets.
Author (AIAA)

Helicopter Design; Cockpits; Airframes; Aircraft Pilots; Lift

19980048253

The U.S. Coast Guard HH-65A helicopter

Schlatter, Richard H., Jr., USCG, USA; May 1997; In English

Report No.(s): SAWE Paper 2371; Copyright; Avail: Aeroplus Dispatch

The U.S. Coast Guard maintains and operates a fleet of 95 HH-65A (Dauphin) Short Range Recovery (SRR) helicopters. The fleet is primarily used for Search and Rescue (SAR), law enforcement and pollution response. The HH-65A fleet flies over 49,000 hours annually and will attain 500,000 flight hours in September 1997. This paper covers the evolution of the HH-65A, paying

particular attention to weight growth. The paper first reviews the operational requirements that defined the procurement of the aircraft. Then it examines what modifications affected weight both during development and since delivery. The paper closes with a look at proposed future development and efforts to mitigate the weight growth problem in the HH-65A.

Author (AIAA)

Helicopter Design; Coastal Water; Structural Weight

19980048380 NASA Ames Research Center, Moffett Field, CA USA

Development of Advanced Methods of Structural and Trajectory Analysis for Transport Aircraft *Final Report, 1 Oct. 1995 - 28 Feb. 1998*

Ardema, Mark D., Santa Clara Univ., USA; Windhorst, Robert, Santa Clara Univ., USA; Phillips, James, NASA Ames Research Center, USA; Mar. 1998; 20p; In English

Contract(s)/Grant(s): NCC2-5167; RTOP 522-41-42

Report No.(s): NASA/CR-1998-207770; NAS 1.26:207770; A-98-09997; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper develops a near-optimal guidance law for generating minimum fuel, time, or cost fixed-range trajectories for supersonic transport aircraft. The approach uses a choice of new state variables along with singular perturbation techniques to time-scale decouple the dynamic equations into multiple equations of single order (second order for the fast dynamics). Application of the maximum principle to each of the decoupled equations, as opposed to application to the original coupled equations, avoids the two point boundary value problem and transforms the problem from one of a functional optimization to one of multiple function optimizations. It is shown that such an approach produces well known aircraft performance results such as minimizing the Brequet factor for minimum fuel consumption and the energy climb path. Furthermore, the new state variables produce a consistent calculation of flight path angle along the trajectory, eliminating one of the deficiencies in the traditional energy state approximation. In addition, jumps in the energy climb path are smoothed out by integration of the original dynamic equations at constant load factor. Numerical results performed for a supersonic transport design show that a pushover dive followed by a pull-out at nominal load factors are sufficient maneuvers to smooth the jump.

Author

Supersonic Transports; Optimization; Aircraft Performance; Perturbation; Trajectory Analysis; Cost Effectiveness; Fuel Consumption

19980048691

Systems engineering for commercial aircraft

Jackson, Scott, Douglas Aircraft Co., USA; 1997; In English; ISBN 0-291-39846-4; Copyright; Avail: Aeroplus Dispatch

This book provides the information to apply the systems engineering process to the design of new aircraft, derivative aircraft, and to change-based designs. It explains the principles of systems engineering in understandable terms but does not attempt to educate the reader in the details of the process. The book incorporates the latest thinking by the FAA and JAA to utilize systems engineering in the aircraft certification process.

AIAA

Commercial Aircraft; Systems Engineering; Aircraft Performance

19980048847

Active control of aircraft cabin noise using collocated structural actuators and sensors

Grewal, A., National Research Council of Canada, Ottawa, Canada; Nitzsche, F., National Research Council of Canada, Ottawa; Zimick, D. G., National Research Council of Canada, Ottawa; Leigh, B., De Havilland, Inc., Canada; Journal of Aircraft; Apr. 1998; ISSN 0021-8669; Volume 35, no. 2, pp. 324-331; In English; Copyright; Avail: Aeroplus Dispatch

This paper describes preliminary laboratory experiments conducted on a turboprop aircraft fuselage to reduce propeller-induced tonal cabin noise and vibration. Piezoelectric elements were grouped to construct a long one-dimensional array of actuators bonded to the fuselage in the main sound transmission path at the propeller footprint. Strain gauges and accelerometers were used as alternative sensor devices and were distributed along the actuator in a collocated arrangement. The array of actuators and sensors was designed to work in unison, generating a smart closed-loop array of control elements that possess wave-number filtering properties for the less critical acoustic modes of the cabin. The control system was tested in the laboratory using a simplified propeller pressure loading distribution. Promising results were obtained, as the closed-loop control system proved to be unconditionally stable and capable of significantly attenuating the fuselage vibration in the transmission path at the critical blade passage

frequencies. Moreover, although only one array of control elements was used, interior noise reduction was also observed during the tests, proving the merit of the concept.

Author (AIAA)

Active Control; Noise Reduction; Aircraft Compartments; Turboprop Aircraft; Vibration Damping; Aircraft Noise

19980048849

Automated Form F for the F-16

Smoot, Harold R., Lockheed Martin Tactical Aircraft Systems, USA; May 1997; In English

Report No.(s): SAWE Paper 2366; Copyright; Avail: Aeroplus Dispatch

With the evolution of the F-16 Weapon System, weight and balance technicians face the increasingly complex task of generating Flight Clearance Forms (Form Fs) for the F-16. With time, the limiting weight and balance factors have become more complex. Many errors in interpreting the weight and center-of-gravity results have occurred. The production of additional F-16 Block types increases the number of weight limits, in-flight limits, tire limits, nose wheel steering limits, and fuel capacities. Multiple limits make identifying unsafe aircraft even more critical. The purpose of this paper is to describe a software program, Automated Form F (AFF), which uses data from F-16 weight and balance technical orders to automate the generation of Form Fs. AFF uses aircraft effectivity data to determine the aircraft Block and calculate the forward and aft limits, and determine fuel tank capacities. It calculates all center-of-gravity limits, in-flight limits, and fuel weights and moments. AFF also calculates most forward and most aft conditions. Out-of-limit conditions are displayed in red. This paper provides a history of the development of AFF, its current capabilities, and a discussion of future development. AFF is currently used throughout the world by the USA Air Force, Air Force Reserves, and Air National Guard.

Author (AIAA)

F-16 Aircraft; Weapon Systems; Structural Weight; Center of Gravity; Aircraft Safety; Nose Wheels

19980048851

An approach to weight strategy in conceptual and preliminary design phases

Liu, Julian C. H., Daimler-Benz Aerospace Airbus GmbH, Germany; May 1997; In English

Report No.(s): SAWE Paper 2385; Copyright; Avail: Aeroplus Dispatch

This paper gives a general overview of the interrelations between the weights predicted by the weight engineers and the strategic parameters considered by the management in the conceptual and preliminary design phases. Towards the end of the preliminary design phase, at the latest when the contracts with the launching customers are to be signed, the strategic parameters must have been fixed and the final policy decisions should have been made. So, the weights and parameters discussed in this paper are only for phases up to go-ahead. Also, a general guideline for the process of the weight strategy decisions is described. Although it varies with different companies and for different projects, there are certain commonalities. This paper is based on strategy discussions for some Airbus Industrie new projects.

Author (AIAA)

Aircraft Design; Weight Analysis; Parameter Identification; Structural Weight

19980048852

Advanced fuselage weight estimation for the new generation of transport aircraft

Schmidt, Andreas, Daimler-Benz Aerospace Airbus GmbH, Germany; Laepple, Martin, Daimler-Benz Aerospace Airbus GmbH, Germany; Kelm, Roland, Daimler-Benz Aerospace Airbus GmbH, Germany; May 1997; In English

Report No.(s): SAWE Paper 2406; Copyright; Avail: Aeroplus Dispatch

This paper details the process of the fuselage weight estimation method used in the weights prognosis department at Daimler-Benz Aerospace Airbus. Based on simple input data the software creates a numerical 3-D model of the exposed fuselage surface. The position and size of cutouts can be defined by the program user. In the loads module the introduction of external forces and the calculation of internal loads (due to mass distributions of payload, systems, and structure) are considered. Certification rules, manufacturing procedures, material/structural fatigue, and flight/mission envelopes are taken into account. The structure weight calculation is based on classical theories for strength and stability. For the inclusion of the elastic behavior of the fuselage the structural deformation is calculated by the software. The software tool FAME-F (Fast and Advanced Mass Estimation of Fuselage) is described with emphasis on the multidisciplinary character of the computer approach. This approch allows for fast parametric studies and determination of sensitivities. The development of the software tool FAME-F shows how weight engineering can contribute to the essential reduction of aircraft developing time and costs.

Author (AIAA)

Transport Aircraft; Aircraft Design; Fuselages; Weight Analysis; Mass Distribution; Fatigue Life

Formulation of a comprehensive aeroelastic analysis for tilt-rotor aircraft

Srinivas, Venkataraman, Maryland, Univ., College Park, USA; Chopra, Inderjit, Maryland, Univ., College Park; Journal of Aircraft; Apr. 1998; ISSN 0021-8669; Volume 35, no. 2, pp. 280-287; In English

Contract(s)/Grant(s): DAAH04-94-G-0074; Copyright; Avail: Aeroplus Dispatch

A comprehensive aeroelastic analysis is developed to predict the performance, vibratory loads, and aeroelastic stability of composite-coupled advanced-geometry tilt-rotors. Elastic motion of the rotor blades, wing, and fuselage and gimbal motion are modeled. Full wingspan and twin rotors are modeled. Finite element modeling is used along with normal mode reduction to make the analysis robust and efficient. Flight conditions modeled are helicopter (hover and forward flight), conversion, and airplane modes of operation. Predictions from this analysis for trim controls, response, loads, and aeroelastic stability correlate well with flight test data and predictions from other established analyses.

Author (AIAA)

Aeroelasticity; Tilt Rotor Aircraft; Finite Element Method; Free Vibration; Aerodynamic Configurations

06
AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

Short communication: Aircraft interior panels tested according to the maritime high-speed craft code

Mitusch, Philip D., Norwegian Defence Research Establishment, Norway; Fire and Materials; July-August, 1997; ISSN 0308-0501; Volume 21, no. 4, pp. 187-189; In English; Copyright; Avail: Issuing Activity

The fire standard for aircraft interior panels has been compared to the corresponding marine standard with respect to smoke emission and heat release rate. This has been performed by testing an aircraft panel approved by the Federal Aviation Administration according to one of the International Maritime Organization standards for High-Speed Craft, according to the full-scale room fire teat, ISO 9705. The test showed that even if the panel met the strict requirements of the Federal Aviation Administration it did not fulfil the apparently even stricter requirements of the International Maritime Organization, The panel failed on several accounts, including smoke production, heat release and structural integrity.

Author (EI)

Aircraft Compartments; High Speed; Aircraft Equipment; Aircraft Parts; Standards; Flammability; Panels; Fire Prevention

Guidance and Flight Director development environment for the V22 Osprey

Mihalszki, John, Boeing Helicopters, USA; Bortkiewicz, Feliks, Boeing Helicopters, USA; Kelly, Kevin, Boeing Helicopters, USA; 1997; In English; Copyright; Avail: Aeroplus Dispatch

This paper describes the three phase approach used to develop the V-22 guidance and flight director algorithm. The first phase dealt with an extensive analysis of the previous V-22 implementation and sought the identification of design improvements to the original baseline. The second phase subjected the enhanced designs to various simulation environments. These included unit, procedure, program level, mainframe computational, and man-in-loop simulation evaluations. Through the use of these sophisticated analytical tools, improvements were identified and incorporated into the algorithm design. The results of these simulations are being used to further amend and 'fine tune' the algorithms. The third phase incorporated the new or modified algorithms into the target host advanced mission computer. This phase included the testing of the complex algorithms in a real-time embedded environment. The use of this technique resulted in a reduction of the development time needed for the implementation of these functions. The G&FD design objectives, the engineering environment, and the software tools used to enhance the successes realized in the G&FD segment of the V-22 program are discussed.

Author (AIAA)

V-22 Aircraft; Guidance (Motion); Flight Control; Avionics

Real-time I/O subsystem of the Comanche RAH-66 signal processor

Calatayud, Richard, Northrop Grumman Corp., USA; Deshpande, Sonal, Northrop Grumman Corp., USA; Hardesty, Mark, Northrop Grumman Corp., USA; Shauck, Steven, Northrop Grumman Corp., USA; Whyms, Robert, Northrop Grumman Corp., USA; 1997; In English; Copyright; Avail: Aeroplus Dispatch

This paper describes the architecture, features, and real-time I/O capability of the Comanche RAH-66 Mission Computer Cluster signal processor. This signal processor was designed and developed by Northrop Grumman. This paper provides a brief history of the processor architecture, as well as details of the unique features which provide a solution to the issue of supporting a 21st century, lightweight, military reconnaissance helicopter. In particular, the paper describes the real-time performance of the Signal Processing Elements (SPEs) and the simultaneous I/O transfers within the supporting storage buffer, the Processor Bulk Memory.
Author (AIAA)
Real Time Operation; Signal Processing

19980047463
V-22 FLIR technology insertion - A 480 x 640 staring FLIR for the V-22 aircraft

Andrew, J., Hughes Aircraft Co., USA; Redmond, D., Hughes Aircraft Co., USA; Eucker, S., Boeing Defense & Space Group, Helicopters Div., USA; Winter, P., Boeing Defense & Space Group, Helicopters Div., USA; 1997; In English; Copyright; Avail: Aeroplus Dispatch

Hughes Aircraft Company is designing and building the midwave IR staring FLIR for the Navy's V-22 tilt rotor aircraft, with the delivery of the first system scheduled for August 1996. The choice of the midwave IR band allows high performance in a very compact, small aperture sensor. The FLIR weighs less than 100 lb and consists of a 12-inch-diameter by 15-inch-high turret and an 8 by 12 by 16-inch off-gimbal electronics unit. to minimize risk, the sensor makes maximum use of existing hardware designs, particularly the AN/AAQ-16B linearly scanned FLIR. The focal plane array (FPA) is a high-performance 480 by 640 indium anti-monide (InSb) hybrid array operating in the 3.7- to 5.0-micron spectral band. The optical system is all reflective, F/3.4 with two FOVs, 30 by 40 deg (0.7 inch aperture) and 5 by 6.7 deg (13 inch aperture). The design allows for the future addition of a third, higher, magnification FOV and an eyesafe laser range finder. Line of sight stabilization is accomplished by means of a two-axis gimbal, with an image motion compensation mirror for fine control.
Author (AIAA)
V-22 Aircraft; FLIR Detectors; Aircraft Design

19980047464
Integrated targeting on the EOC Comanche

Capron, G. F., Boeing Rotorcraft, USA; 1997; In English; Copyright; Avail: Aeroplus Dispatch

This paper provides an overview of the Early Operational Capability (EOC) Comanche Mission Equipment Package (MEP) Target Acquisition System functional capabilities and shows how these capabilities blend in the integrated Operational Flight Program (OFP) software to provide automated sensor control, crew situation awareness, and digital message management. The process of designing, allocating, and subdividing the capabilities/requirements between the software configuration items is discussed. It is shown how the software integration process uses the design, captured in the lower level requirements documents and the interface control documents, to integrate and test the software operation at the OFP level.
Author (AIAA)
Military Helicopters; Avionics; Systems Integration; Software Development Tools

19980047466
Direct Voice Input for control of an avionics management system

Swail, Carl, NRC of Canada, Ottawa, Canada; Kobierski, Robert, Canadian Marconi Co., Canada; 1997; In English; Copyright; Avail: Aeroplus Dispatch

This paper deals with the application of speech recognition in the helicopter cockpit environment. Direct Voice Input (DVI) avionics command systems, when employed properly, can reduce operator workload, enhance safety and improve situational awareness. A speaker-dependent connected speech recognition system has been developed at the National Research Council (NRC) and, in cooperation with the Canadian Marconi Company, integrated into an Avionics Management System (AMS). An operator interface was designed to allow manipulation of the communications functions of the AMS and was installed in the NRC Bell 412 helicopter. The system was evaluated during actual flight conditions by NRC and Canadian Forces pilots. Test scenarios included the use of a ground controller passing radio frequencies to the evaluation pilot who, while flying standard circuits, changed RFs using the AMS either manually or by voice. The utility of DVI was also examined during a simulated operational mission. The average recognition accuracy of the system for pilots with a small amount of training on the use of DVI was 94.9 percent.
Author (AIAA)
Avionics; Management Systems; Speech Recognition; Cockpits; Helicopters

Electronic kneeboard development for aviation use

Spura, Thomas M., Lockheed Martin Federal Systems, USA; 1997; In English; Copyright; Avail: Aeroplus Dispatch

We have been studying methods for taking electronic data into the cockpit in lieu of using conventional paper products. Computer processing has become powerful enough to allow the elimination of paper in the cockpit, while providing easier access to any data the aviator may need. We developed a prototype kneeboard-type device for data access using a palm top computer with touch screen interfacing. This unit is called the Aviator's Associate and is initially targeted to military helicopter aviators, with growth to assist all forms of aviation, including fixed wing, crew chief and even maintenance functions. The development process has provided a wealth of design considerations that were solved using models, input from pilots, and adaptations to existing products. This paper describes the development cycle and concerns that evolved during the R&D process. It outlines the development process, modifications made to improve the product, and lessons learned during development.
Author (AIAA)
Cockpits; Airborne/Spaceborne Computers; Pilot Support Systems; Pilot Performance

ANVIS HUD helmet mounted display (day/night)

Waage, Robert N., Tracor Aerospace, USA; 1997; In English; Copyright; Avail: Aeroplus Dispatch

A dangerous situation is created when the pilot looks inside the cockpit for instrument information when flying combat and low altitude missions. While looking at instruments, a pilot cannot be performing situation analysis; yet, not looking at instruments runs such risks as flying into the ground, particularly in low visibility conditions or in relatively featureless terrain, where visual cues for altitude and attitude are inadequate or deceptive. The AN/AVS-7 HMD (Helmet Mounted Display) solves this problem for night flight for both helicopters and fixed wing aircraft which must operate in a 'nap of the Earth' flight regime. The display unit mounts on the AN/AVS-6 night vision goggles and provides symbology overlaid on the pilot's outside view; cockpit instrument information is thus provided through the goggles. An optional raster/stroke interface now available for both the day and night HMD variants of the AN/AVS-7 enables the display of television-like video from sensors, such as forward-looking IR, while retaining the advantages of cursive (stroke) symbology when that is most appropriate. The IR video supplements the night vision goggle capability, extending the 'head out of cockpit' usefulness into additional light levels and atmospheric conditions.
Author (AIAA)
Helmet Mounted Displays; Cockpits

Development of the AN/APQ-174D Multi-Mode Radar for the Air Force CV-22

Teeple, James R., USAF, Special Operations Command, USA; Kaser, David, Raytheon TI Systems, Inc., USA; 1997; In English; Copyright; Avail: Aeroplus Dispatch

The AN/APQ-174 Multi-Mode Radar (MMR) provides safe, low-level flight down to a 100-ft set clearance at night, in adverse weather and in high-threat environments for a variety of aircraft. The radar enables an aircraft to perform special operations, including combat search and rescue missions, which involve penetrating hostile enemy territory under cover of darkness and adverse weather to deliver (or retrieve) special operations teams or rescue downed airmen and return them to safety. Several new modes have been added, such as weather detection, beacon interrogation, and low power/low velocity, which will provide terrain-following capability down to 5 knots. This paper provides a brief description of the MMR and describes in detail the new modes and other improvements in processing capability and size/weight/power reductions being developed for the CV-22 AN/APQ-I74D MMR. An operational view of the benefits to the future pilots of the CV-22 is also provided.
Author (AIAA)
V-22 Aircraft; Airborne Radar

Remote Bold Eagle - Cockpit control of unmanned aerial vehicles

Barton, Vance L., Bell Helicopter Textron, Inc., USA; Holley, C. D., Bell Helicopter Textron, Inc., USA; 1997; In English; Copyright; Avail: Aeroplus Dispatch

This paper focuses on the technology required to perform the advanced mission concept of a 'Scout for a Scout', wherein the scout aircraft (a modified OH-58D) uses and controls the unmanned aerial vehicle (UAV) (in this case Bell's Tiltrotor Unmanned System, the Eagle Eye) to expand the capabilities of the traditional scout mission. The capabilities that have been investigated include the cockpit controls and displays required to remotely control the UAV from the OH-58D for such entities as navigation, mine detection, remote lasing, unique weapons, data collection, and target detection. The man-machine interface (MMI),

including alternative technologies and approaches, for controlling the UAV using man-in-the-loop simulation as the primary evaluation tool is described.

Author (AIAA)

Cockpits; Remotely Piloted Vehicles; Man Machine Systems; Computerized Simulation; Command and Control

19980047719
BellBoeing 609 commercial tiltrotor cockpit display design

Fischer, Douglas S., Boeing Rotorcraft Defense and Space Group, USA; Buck, Richard W., Boeing Rotorcraft Defense and Space Group, USA; 1997; In English; Copyright; Avail: Aeroplus Dispatch

Given size, weight, and cost constraints for the 609, the baseline designs of the BellBoeing 609 (609) cockpit displays relied upon the effective application of human performance theory and redundancy management. Three active matrix liquid crystal displays (AMLCD) were integrated into the cockpit to present the Primary Flight Display (PFD) and Engine Instrument Cockpit Alerting System (EICAS) parameters. Numerous display prototypes were developed and evaluated in terms of their effectiveness in displaying critical tiltrotor information. The selection and display of flight parameters for the PFDs and the EICAS were based on both criticality and the frequency in which displays were accessed. FAA certification requirements specified necessary design regulations to satisfy situational awareness and redundancy issues. Due to the unique characteristics of tiltrotor aircraft, the baseline displays provide a new level of pilot performance requirements, while maintaining consistent cockpit display principles and requirements.

Author (AIAA)

Tilt Rotor Aircraft; Cockpits; Display Devices; Liquid Crystals

19980047721
Comanche controls and displays - Current configuration and planned advancements

Nerius, Kenneth J., Harris Corp., USA; 1997; In English; Copyright; Avail: Aeroplus Dispatch

The U.S. Army's Comanche RAH-66A Scout/Attack Helicopter has just completed a five year demonstration/validation program that developed a modular controls and displays (C&D) subsystem. The C&D subsystem consists of SEM-E modules that reside within centralized mission computers (MCs) and an all glass crew station. The modular architecture allows easy modifications to the hardware and software without major system impacts. The current crew station interfaces consist of two primary display elements - a color 640 x 480 pixel group Active Matrix Liquid Crystal Multi-Function Display (MFD) and a monochromatic 1280 x 480 pixel MFD. The two MFDs are mounted side by side in the crew station, providing a maximum display surface within a limited FOV. Data transmitted to the video displays include artificial flight instruments, digital moving maps for navigation and threat avoidance, and high resolution FLIR images for manual threat targeting. Two MultiPurpose Displays (MPDs) with embedded graphics generators augment the MFDs. The MPDs provide continuous situational data on weapons status, radio selection, and system health.

Author (AIAA)

Military Helicopters; Helicopter Control; Display Devices

19980047722
Advanced system and technology integration - The SuperCockpit

Holley, C. D., Bell Helicopter Textron, Inc., USA; 1997; In English; Copyright; Avail: Aeroplus Dispatch

In early 1996, Bell Helicopter Textron, Incorporated, expanded a research program, which focused on advanced cockpit and weapons technology for the future battlefield, to additionally include advanced software and avionics technology for the development and production environments. The cockpit development portion of the program is the focus of this paper. The ASTI Super-Cockpit supports future digital battlefield operations via an advanced technology mission equipment package (MEP, which includes hardware and software) integrated at the human-machine level by the cockpit design. The cockpit represents one of the world's most capable and integrated attack helicopter crewstations, incorporating the latest techniques in 'glass cockpit' design. These techniques include mission-oriented applications of automation, ensuring that the right information is available to the crew at the right time, improved geometric accommodation, and usability testing to reduce crew workload and enhance situational awareness and mission effectiveness. Results of a recent evaluation are presented along with design modifications currently being implemented.

Author (AIAA)

Systems Integration; Cockpits; Artificial Intelligence; Decision Making; Cognition

Rotorcraft Pilot's Associate

Johnson, Dale, U.S. Army, Aviation Applied Technology Directorate, USA; 1997; In English; Copyright; Avail: Aeroplus Dispatch

The Rotorcraft Pilot's Associate (RPA) is an application of AI and advanced computing technologies to create a cognitive decision aiding system (CDAS) for future combat helicopter pilots. RPA will understand and use information gathered from remote sensors, teammates, and organic mission equipment to develop plans that facilitate the achievement of mission objectives for individual platforms and teams of aircraft. This paper discusses the end-to-end RPA cognitive decision aiding process. It highlights the associate qualities created by the interaction of the task network architecture (TNA) and crew intent estimation (CIE). In addition, it discusses how RPA uses relevant battlefield information to aid the mission execution process. The paper specifies the methods by which the cockpit information manager (CIM) prevents information overload by determining what, when, and where plans and data are displayed based on individual crew preferences and mission context. It identifies the primary technical challenges and closes with an update of program status.

Author (AIAA)

Pilot Support Systems; Aircraft Pilots; Pilot Performance; Artificial Intelligence; Cognition

Transition of Rotorcraft Pilot's Associate cognitive decision aiding to tactical production rotorcraft

Glickstein, Ira S., Lockheed Martin Federal Systems, USA; Ives, Sherry A., Lockheed Martin Federal Systems, USA; Stopper, Bernie A., Lockheed Martin Federal Systems, USA; 1997; In English; Copyright; Avail: Aeroplus Dispatch

The cognitive decision aiding (CDA) functionality of the Rotorcraft Pilot's Associate (RPA) project has been transitioned from the large and heavy simulation laboratory processor to a flyable processor suitable for a tactical helicopter. Software developed on a powerful Silicon Graphics multiprocessor that weighs 800 lb and takes up 40 cu ft is now running on our Real-Time Symmetric MultiProcessor (RTSMP) that weighs only 70 lb and takes up less than 2 cu ft. The rugged VME version has passed environmental testing and is available for RPA flight demonstration, scheduled for early 1998. RPA software was developed in the C++ language. Use of commercial off-the-shelf (COTS) hardware and software assures that RTSMP performance will continue to increase at the high rates typical of the commercial UNIX workstation and PC markets. Our success in this effort demonstrates the potential advantages of ruggedized COTS hardware, COTS operating systems, and commercial software development languages.

Author (AIAA)

Pilot Support Systems; Cognition; Pilot Performance; Software Engineering

AHS Avionics and Crew Systems Technical Specialists' Meeting, Philadelphia, PA, Sept. 23-25, 1997, Proceedings

1997; In English; Copyright; Avail: Aeroplus Dispatch

The present volume on avionics and crew systems sensors and software, cockpit control and displays, communication and navigation, and architecture and processors. Attention is given to staring FLIR for the V-22 aircraft, systems and software in concurrent engineering, the transition of Rotorcraft Pilot's Associate cognitive decision aiding to tactical production rotorcraft, and direct voice input for control of an avionics management system. Other topics addressed include current configurations and future advances in Comanche controls and displays, 609 cockpit display design, recent developments in aircraft intercommunications systems, and avionics integration for the Kiowa Warrior.

AIAA

Conferences; Avionics

A new generation video Automatic Target Tracker

Westling, Edward M., Northrop Grumman ESSD, USA; Logan, Dale R., Northrop Grumman ESSD, USA; 1997; In English; Copyright; Avail: Aeroplus Dispatch

The RAH-66 Comanche Automatic Target Tracker (ATT) provides state-of-the-art video tracking through a robust architecture suited for growth and change. The hardware and software are based upon a kernel design that integrates with various IR and

TV sensors, military and commercial buses, and platform vehicles. Through modern design principles, the architecture endorses both planned and unplanned product improvements, adaptations to varying roles, and greater mission effectiveness.
Author (AIAA)
Video Signals

19980047760

Kiowa Warrior Control and Display System development for Task Force XXI

Fitzgerald, Frank, U.S. Army, Kiowa Warrior Program Office, USA; Kawa, Mike, Bell Helicopter Textron, Inc., USA; Riter, Joseph G., Honeywell Defense Avionics Systems, USA; 1997; In English; Copyright; Avail: Aeroplus Dispatch

This paper describes the Kiowa Warrior Helicopter Control and Display System (CDS) Honeywell developed for use in the Task Force XXI Advanced Warfighting Experiment (TFXXI AWE). The TFXXI AWE is staged to demonstrate the capabilities of battlefield digitization. The Kiowa Warrior will be used in the experiment as part of an aviation brigade. Digitization functionality will be required on the Kiowa Warrior, but supplying this capability in an add-on manner via Applique will not be feasible due to the real-time constraints of the system and the requirement to keep the user interface consistent with current tactics, techniques, and procedures. Since the embedded processing capability was deemed adequate, and distal map and Improved Data Modem capability will be resident in the current CDS, the Kiowa Warrior Program office opted to have Honeywell provide the digitization functionality within the Kiowa Warrior CDS as apposed to adding the Applique.
Author (AIAA)
Helicopter Control; Display Devices; Military Helicopters

19980047761

High leveraged insertion into Comanche of integrated avionics technology developed under the F-22 program demonstrates multiservice applicability

Nodes, T. A., TRW, Inc., Avionics Systems Div., USA; Campbell, M. E., TRW, Inc., Avionics Systems Div., USA; 1997; In English; Copyright; Avail: Aeroplus Dispatch

This paper describes Comanche integrated communication architecture and its implementation of the diverse Comanche requirements. The selected approach for the Comanche communication subsystem is the use of the Integrated Communications, Navigation, IFF Architecture, ICNIA, technology which is under manufacturing development under the F-22 program after the successful demonstration of the architecture in the ICNIA Advanced Development Model (ADM) and YF-22/YF-23 Dem/Val technology programs. The ICNIA architecture utilizes common modules and software to implement a range of radio functions with core set of hardware. In many cases new radio functions and networking (such as digital battlefield) can be implemented as a software update without changes in hardware, and hardware when required is added as module inserts into integrated avionics racks. The addition of the growth functions LINK 16, LINK 16 to VMF translation and Constant Source to the Comanche EOC architecture is also discussed.
Author (AIAA)
F-22 Aircraft; Avionics; Weapon Systems

19980048185

Solving the problem of the optimal autonomous estimation of the stochastic state vector of an aircraft navigation system
O reshenii zadachi optimal'noj avtonomnoj otsenki stokhasticheskogo vektora sostoyaniya navigatsionnoj sistemy samoleta

Sokolov, S. V., Rostovskoe Vysshee Voennoe Komandno-Inzhenernoe Uchilishche Raketnykh Vojsk, Russia; Pogorelov, V. A., Rostovskoe Vysshee Voennoe Komandno-Inzhenernoe Uchilishche Raketnykh Vojsk, Russia; Sokolov, S. V., Russian Federation; Pogorelov, V. A.; Aviatsionnaya Tekhnika; 1997; ISSN 0579-2975, no. 3, pp. 22-28; In Russian; Copyright; Avail: Aeroplus Dispatch

The problem of estimating the state vector of an aircraft navigation system is solved for general assumptions about the drifts of a hydrostabilized platform carrying accelerometers and orthogonal velocimeters and about the statistical properties of instrument errors. The validity of the approach proposed here is demonstrated by a numerical simulation. The maximum errors of the estimates of the state vector components are 17 percent for the vertical velocity component, 2.45 percent for the orientation angles, and 1.25 percent for the angular velocity projections.
AIAA
Aircraft Instruments; Autonomous Navigation; Optimal Control; Stochastic Processes; State Vectors

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxiliary power plants for aircraft.

Transient characteristics induced by heat addition in SCRAMJET engine

Kim, J., Dep. of Aeronautics and Astronautics; Namba, M.; Memoirs of the Faculty of Engineering, Kyushu University; June, 1997; ISSN 0023-6160; Volume 57, no. 2, pp. 89-106; In English; Copyright; Avail: Issuing Activity

The paper presents numerical solutions of the two-dimensional Euler and Navier-Stokes equations for supersonic unsteady flows in a convergent-divergent duct with heat addition. The Van Leer FVS (flux vector splitting) method in generalized coordinates is employed in order to calculate inviscid strong shock waves caused by thermal choking. While FDS (flux difference splitting) method with TVD scheme is used for viscous calculations. Discussions are made on transient characteristics, start and unstart phenomena induced by thermal choking, limit of equivalence ratio to avoid thermal choking and viscous effects.
EI

Heat Engines; Supersonic Combustion Ramjet Engines; Supersonic Flow; Shock Waves; Temperature Effects; Numerical Analysis

19980047633

Experiments on cruise propulsion with a hydrogen scramjet

Stalker, R. J., Queensland, Univ., Australia; Paull, A., Queensland, Univ., Australia; Aeronautical Journal; Jan. 1998; ISSN 0001-9240; Volume 102,, no. 1011, pp. 37-43; In English
Contract(s)/Grant(s): NAGW-674; Copyright; Avail: Aeroplus Dispatch

Measurements of drag have been made in a shock tunnel on a simple integrated vehicle-engine combination for hypersonic cruise with hydrogen scramjet propulsion. The test flow Mach number was 6.4, and the velocity was 2.45 km/s. Zero drag, which is the necessary condition for cruise, was achieved as the equivalence ratio approached one. It was found that an analysis using established aerodynamic concepts was adequate for predicting drag in the case of no combustion. When combustion occurred, results of direct connect experiments provided a qualitative guide to the measured levels of drag and indicated that thrust nozzle combustion was taking place. A heuristic analysis is used to point to the important effect this may have on propulsive lift.
Author (AIAA)

Supersonic Combustion Ramjet Engines; Cruising Flight; Drag Measurement; Shock Tunnels

19980047801

Optimum engine control

AeroSpace; Feb. 1998; ISSN 0949-7064, no. 1, pp. 26-28; In English; Copyright; Avail: Aeroplus Dispatch

A fully digital control with the associated flight safety software has been developed for the Eurofighter's EJ200 engine. It provides optimum engine performance characteristics while ensuring good fuel economy, high reliability, and minimum workload for the pilot. It radically reduces maintenance requirements and keeps the engine operating safely even under off-design conditions. It integrates smoothly with the Eurofighter's flight control and avionics systems.
AIAA

Engine Control; Electronic Control; Software Development Tools

19980048036

Studies into hail ingestion of turbofan engines using a rotating fan and spinner assembly

Pan, H., Loughborough Univ. of Technology, UK; Render, P. M., Loughborough Univ. of Technology, UK; Aeronautical Journal; Jan. 1998; ISSN 0001-9240; Volume 102,, no. 1011, pp. 45-51; In English; Copyright; Avail: Aeroplus Dispatch

Simulated hailstones were made to impact on the rotating spinner and fan assembly of a Williams FJ44 engine. The mass distribution of ice behind the fan was determined by use of a suction tube technique. Suction was added to ensure that the tube did not affect the flow through the fan assembly. The strong air flow behind the fan meant that the ice caught by the tube melted and evaporated. This made it difficult to accurately determine the mass distribution of ice. As a result, the simulated hailstones were made from a water-salt solution so that the weight of salt residue could be measured after the water had evaporated, and hence the amount of ice caught was determined. A parametric study into the hail ingestion characteristics of the fan assembly was carried out. The parameters studied included the radial position of the impact point, the rotational speed of the fan, and the position of the splitter between the core engine and bypass duct. The results showed that the impact position had a major effect on the overall

ice distribution, which was determined by the combination of blade geometry at the impact point and the rotational speed. The splitter position was shown to have a significant effect on the amount of ice passing into the bypass duct.
Author (AIAA)
Turbofan Engines; Ingestion (Engines); Hail; Fan Blades; Mass Distribution; Rotor Speed

19980048038
Variable cycle jet engines for a Mach 2.7 supersonic civil transport
Aleid, L., Cranfield Univ., UK; Pilidis, P., Cranfield Univ., UK; Aeronautical Journal; Jan. 1998; ISSN 0001-9240; Volume 102,, no. 1011, pp. 31-36; In English; Copyright; Avail: Aeroplus Dispatch

The aim of the present work is to compare three different variable cycle jet engine concepts for future SSTs. These engines are: the turbofan-turbojet, the mid-tandem fan engine, and the double bypass engine. The comparison is carried out on the basis of uninstalled and installed performance, handling and sizing issues. This preliminary analysis compares SFC, size, variable geometry, and cycle changes for each engine. The installed performance was estimated by calculating the air friction, and the pre-entry and the afterbody drags, together with the wave drag due to the shock waves. A sizing calculation was carried out for the whole nacelle. The uninstalled and installed fuel bill, for two standard missions, is also estimated. These preliminary results indicate that the turbofan-turbojet and the mid-tandem fan engines are quite similar in terms of general suitability. The mid-tandem fan appears to be an attractive proposition from the point of view of sizing, but this comes with a small penalty in fuel consumption. The present double bypass engine was found to be the least attractive for the application, although the differences are small.
Author (AIAA)
Transport Aircraft; Civil Aviation; Bypass Ratio; Turbofan Engines; Turbojet Engines; Supersonic Transports

19980048047
Power is control
Donaldson, Peter; Helicopter World; Feb. 1998; ISSN 0262-0448; Volume 17, no. 1, pp. 15-17; In English; Copyright; Avail: Aeroplus Dispatch

Full Authority Digital Engine Control (FADEC) is now commonly used on new helicopter types as a new generation of cheaper and more capable systems emerges. The main components of a FADEC are a digital electronic control unit (ESU), a hydrodynamic metering assembly (HMA), which includes the fuel pump and metering section, and the wiring harnesses that connect the ECU and the HMA to sensors on the engine and airframe. A new generation of FADECs, currently under development, can easily be adapted to match the specific requirements of a broad range of turbojet engines.
AIAA
Numerical Control; Engine Control; Helicopter Engines

19980048172
A method for determining losses in a channel due to a change in longitudinal wall curvature *Metod opredeleniya poter' v kanale, vyzvannykh izmeneniem prodol'noj krivizny stenki*
Bogomolov, E. N., RGATA, Russia; Khodak, E. A., RGATA, Russia; Aviatsionnaya Tekhnika; 1997; ISSN 0579-2975, no. 3, pp. 88-93; In Russian; Copyright; Avail: Aeroplus Dispatch

A method is proposed for calculating the height of separation zones formed as a result of changes in channel wall curvature. The associated losses in the channel are determined by using a model of a sudden expansion of a nonuniform flow. The results of calculations are compared with experimental data.
AIAA
Aircraft Engines; Combustion Chambers; Nonuniform Flow; Channel Flow; Duct Geometry; Energy Dissipation

19980048175
A study of heat transfer from the cylindrical surfaces of the spacer rings inside the disk/drum rotor of a gas turbine engine
Issledovanie teplootdachi tsilindricheskikh poverkhnostej prostavochnykh kolets v polosti diskobarabannogo rotora GTD
Salov, N. N., Sevastopol'skij Gosudarstvennyj Tekhnicheskij Univ., Ukraine; Kalinin, S. A., Sevastopol'skij Gosudarstvennyj Tekhnicheskij Univ., Ukraine; Tverskaya, S. E., Sevastopol'skij Gosudarstvennyj Tekhnicheskij Univ., Ukraine; Vovk, A. I., ZMKB 'Progress', Ukraine; Aviatsionnaya Tekhnika; 1997; ISSN 0579-2975, no. 3, pp. 75-78; In Russian; Copyright; Avail: Aeroplus Dispatch

The effect of heat transfer from the spacer rings inside the disk/drum rotor of a gas turbine engine with axial coolant flow was investigated experimentally for the case of heat transfer between the steel disks and the spacer rings. It is shown that heat transfer increases with the flow rate of the hot coolant exiting the rotor cavity. It is also found that heat transfer from the cylindrical

surfaces in a rotating cavity with axial coolant flow in the case of a thermally insulated disk equals 0.9-0.5 of the heat transfer coefficient on the cylindrical surfaces in the case where a thermally insulated disk has been replaced by a steel disk.
AIAA

Gas Turbine Engines; Aerodynamic Heat Transfer; Rotor Aerodynamics; Spacers; Engine Parts; Engine Coolants

19980048176

Microwave emission mechanisms of jet exhaust *K voprosu o mekhanizmakh SVCH-izluchenij reaktivnogo vykhlopa*

Potapov, G. P., Kazanskij Gosudarstvennyj Tekhnicheskij Univ.-Kazanskij Aviatsionnyj Inst., Russia; Aviatsionnaya Tekhnika; 1997; ISSN 0579-2975, no. 3, pp. 71-74; In Russian; Copyright; Avail: Aeroplus Dispatch

A physical model is proposed for the microwave emission of the jet exhaust. The parameters of the microwave emission of the jet exhaust are estimated, and the estimates are found to be consistent with experimental data. It is noted that the microwave emission of the exhaust is modulated by low-frequency fluctuations associated with the working cycle and secondary processes in the engine.
AIAA

Aircraft Engines; Jet Exhaust; Microwave Emission; Exhaust Gases

19980048177

Control law synthesis for the phase synchronization of propfan propellers using Pontryagin's maximum principle *Sintez zakonov upravleniya protsessom sinkhrofazirovaniya vintov TVVD s pomoshch'yu printsipa maksimuma L. S. Pontryagina*

Kabal'nov, Yu. S., Ufimskij Gosudarstvennyj Aviatsionnyj Tekhnicheskij Univ., Russia; Kuznetsov, I. V., Ufimskij Gosudarstvennyj Aviatsionnyj Tekhnicheskij Univ., Russia; Aviatsionnaya Tekhnika; 1997; ISSN 0579-2975, no. 3, pp. 64-70; In Russian; Copyright; Avail: Aeroplus Dispatch

A method is proposed for the synthesis of relay control laws optimized for the minimum time of response. The method is based on the decomposition of the initial multivariable plant into independent single-input controlled subsystems. The problem of the synthesis of relay control laws is solved for each individual subsystem.
AIAA

Aircraft Engines; Propeller Fans; Pontryagin Principle; Propeller Efficiency; Time Optimal Control; Control Systems Design

19980048178

Increasing the efficiency of the turbostarters of aircraft gas turbine engines using intermittent combustion *Povyshenie ehffektivnosti turbostarterov aviatsionnykh GTD pri periodicheskom sgoranii*

Mikhal'tsev, V. E., Moskovskij Gosudarstvennyj Tekhnicheskij Univ., Russia; Molyakov, V. D., Moskovskij Gosudarstvennyj Tekhnicheskij Univ., Russia; Potapova, I. A., Moskovskij Gosudarstvennyj Tekhnicheskij Univ., Russia; Aviatsionnaya Tekhnika; 1997; ISSN 0579-2975, no. 3, pp. 48-55; In Russian; Copyright; Avail: Aeroplus Dispatch

The efficiency of gas turbine engines with two-valve, single-valve, and valveless combustion chambers is examined. The advantages of gas turbine engines with single-valve combustion chambers and combustion chambers with combined valves are demonstrated. Results of experimental/analytical studies are presented in which an intermittent combustion cycle was used in turbostarters with two-valve and single-valve combustion chambers in an attempt to increase the efficiency of the starting process.
AIAA

Gas Turbine Engines; Engine Starters; Aircraft Engines; Combustion Efficiency; Fuel Valves; Combustion Chambers

19980048180

Increasing the gasdynamic efficiency of nozzle grids with thick airfoils *Povyshenie gazodinamicheskoj ehffektivnosti soplovykh reshetok s tolstymi profilyami*

Mamaev, B. I., ABB 'Uniturbo', Russia; Shuverova, T. I., AO SNTK im. N. D. Kuznetsova, Russia; Aviatsionnaya Tekhnika; 1997; ISSN 0579-2975, no. 3, pp. 44-47; In Russian; Copyright; Avail: Aeroplus Dispatch

Some guidelines are presented for improving the gasdynamic characteristics of nozzle grids consisting of thick airfoils. These guidelines are based on the known fact that changes in the trough shape have a relatively small effect on the cascade efficiency. The advantages of the design approach proposed here are demonstrated by experimental data.
AIAA

Aircraft Engines; Airfoil Profiles; Gas Dynamics; Nozzle Geometry; Cascade Flow; Engine Design

In-situ measurements in aircraft exhaust plumes and in the North Atlantic flight corridor
Schlager, Hans, DLR, Inst. fuer Physik der Atmosphaere, Germany; Schulte, Peter, DLR, Inst. fuer Physik der Atmosphaere, Germany; Ziereis, Helmut, DLR, Inst. fuer Physik der Atmosphaere, Germany; Pollutants from air traffic - Results of atmospheric research 1992-1997; 1997, pp. 57-66; In English; Copyright; Avail: Aeroplus Dispatch

Aircraft-borne in situ measurements of NO, NO2, O3, and CO2 were performed in the upper troposphere and lowermost stratosphere over the eastern North Atlantic, including observations in aircraft exhaust plumes. The near-field plume measurements provided in-flight NO(x) emission measurements of commercial jet aircraft for cruising conditions. The inferred NO(x) emission indices range between 8.5-13 g No2/kg fuel for short- to medium-range aircraft and 12.3-30.4 g No2/kg fuel for long-range airliners. Corresponding predictions of NO(x) emission indices are on average 12 percent lower than the measurements. The observations in the North Atlantic flight corridor reveal small-scale signatures of air-traffic NO(x) emissions. These NO(x) peaks could be attributed to individual exhaust plumes or superpositions of air-traffic plumes with ages between minutes and hours. The large-scale NO(x) measurements in the corridor region show highly variable NO(x) concentration profiles from flight to flight and for the different campaigns.
Author (AIAA)
Aircraft Engines; Exhaust Gases; Plumes; Troposphere; Stratosphere; Air Traffic

Aircraft specific exhaust emissions
Lecht, Manfred, DLR, Inst. fuer Antriebstechnik, Germany; Deidewig, Frank, DLR, Inst. fuer Antriebstechnik, Germany; Doepelheuer, Andreas, DLR, Inst. fuer Antriebstechnik, Germany; Pollutants from air traffic - Results of atmospheric research 1992-1997; 1997, pp. 27-35; In English; Copyright; Avail: Aeroplus Dispatch

Essential species of aircraft emissions are calculated. Engine performance and emission correlation is modeled, with sea level static measurements from the engine certification process taken as a reference. A flight simulation program is modified to couple aircraft and engine performance along a flight mission profile. Sensitivity studies of the change of emissions along the cruise section showed a 30 percent decrease of the NO(x) emission rate until the end of cruise. Differences of ambient air temperature from ISA conditions will have a substantial impact on NO(x), CO, and HC emissions rather than on mission fuel.
Author (AIAA)
Aircraft Engines; Exhaust Gases; Fuel Consumption; Short Haul Aircraft

CAESAR targets tech transfer
Kandebo, Stanley W., USA; Aviation Week & Space Technology; Feb. 09, 1998; ISSN 0005-2175; Volume 14, no. 6, pp. 89; In English; Copyright; Avail: Aeroplus Dispatch

Under the CAESAR (Component and Engine Structural Assessment Research) program, Pratt & Whitney is conducting cyclic endurance tests with a modified F119 to examine technologies that could be transitioned into engines for production versions of the Joint Strike Fighter and F-22A. The CAESAR tests are being pursued to explore innovative technologies that could be transitioned easily into existing engines. Results from the core engine design verification runs are briefly discussed.
AIAA
Aircraft Engines; Engine Design; Technology Transfer; Fighter Aircraft; Engine Tests

08
AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

NASA Dryden Flight Research Center, Edwards, CA USA
Robust Flutter Margin Analysis that Incorporates Flight Data
Lind, Rick, NASA Dryden Flight Research Center, USA; Brenner, Martin J., NASA Dryden Flight Research Center, USA; Mar. 1998; 102p; In English
Contract(s)/Grant(s): RTOP 529-31-14
Report No.(s): NASA/TP-1998-206543; NAS 1.60:206543; H-2209; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

An approach for computing worst-case flutter margins has been formulated in a robust stability framework. Uncertainty operators are included with a linear model to describe modeling errors and flight variations. The structured singular value, mu, computes a stability margin that directly accounts for these uncertainties. This approach introduces a new method of computing flutter margins and an associated new parameter for describing these margins. The mu margins are robust margins that indicate worst-case stability estimates with respect to the defined uncertainty. Worst-case flutter margins are computed for the F/A-18 Systems Research Aircraft using uncertainty sets generated by flight data analysis. The robust margins demonstrate flight conditions for flutter may lie closer to the flight envelope than previously estimated by p-k analysis.
Author
Flutter Analysis; Aeroelasticity; Mathematical Models; Dynamic Structural Analysis

19980041445 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
Multiple Model Adaptive Estimation and Control Redistribution Performance on the VISTA F-16 During Partial Actuator Impairments, Volume 1
Clark, Curtis S., Air Force Inst. of Tech., USA; Dec. 1997; 135p; In English
Report No.(s): AD-A336725; AFIT/GE/ENG/97D-23-Vol-1; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
Multiple Model Adaptive Estimation with Control Reconfiguration (MMAE/CR) capability to estimate and compensate for partial actuator failures, or "impairments" is investigated using the high-fidelity, nonlinear, six-degree-of-freedom, VISTA F-16 simulation which currently resides on the Simulation Rapid-Prototyping Facility (SRF). After developing a model for inserting partial actuator impairments into the VISTA F-16 truth model, research begins with a battery of single actuator impairment tests. This stage of research explores the capability of the existing MMAE algorithm to estimate single, partial actuator impairments, and helps to define refinements and expansions needed in the MMAE algorithm for the second phase of research: the detection and estimation of dual, total and partial actuator impairments. It is seen from the first stage of research that, while MMAE is able to estimate partial impairments, there are refinements needed, such as 'probability smoothing and quantization', to compensate for the quality of MMAE probability data and to provide a better, more stable estimate value to the Control Reconfiguration module. The Kalman filters and the dual, partial failure filter banks necessary for the detection of dual, partial actuator impairments are also defined as a result of the single impairment tests. Fifteen more banks of "partial first-failure" Kalman filters are added to the existing MMAE algorithm, as well as the 'bank swapping' logic necessary to transition to them. Once the revised and expanded MMAE/CR algorithm is ready, research begins on dual combinations of total and partial actuator impairments. While results of these tests (for other than total impairments) are not as good as originally hoped or expected, the potential.
DTIC
Actuators; Adaptive Control; Algorithms; Controllability; Degrees of Freedom; Electric Batteries; F-16 Aircraft; Kalman Filters; Prototypes; Simulation; Smoothing; Stability

19980041505 Air Force Inst. of Tech., Graduate School of Engineering, Wright-Patterson AFB, OH USA
Constrained Model Predictive Control of a Nonlinear Aerospace System
Shearer, Christopher M., Air Force Inst. of Tech., USA; Dec. 1997; 146p; In English
Report No.(s): AD-A336680; AFIT/GAE/ENY/97D-05; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
Recent research efforts have applied the receding horizon Model Predictive Control (MPC) strategy to linearized high performance aerospace systems. The research contained in this thesis used these recent results in order to apply the MPC strategy to a nonlinear high performance aerospace system, specifically an F-16 fighter aircraft model. The model was commanded to follow dynamic trajectories of roll angle and altitude. Further, adaptive constraint techniques were used to improve system tracking. to accomplish these tasks, code and block diagrams were generated using the commercial software packages of Matlab and Simulink. Numerous simulations were conducted with the goal of achieving realistic aircraft performance. In many cases, to improve system tracking and reduce control input oscillations, rigid mathematical constraints previously used in the MPC strategy were relaxed.
DTIC
Aerospace Systems; Aircraft Models; Aircraft Performance; Applications Programs (Computers); Block Diagrams; Trajectories

19980042309

Mechanism of jet-flutter: Self-induced oscillation of upward plane jet impinging on free surface (2nd report, oscillating system and energy supply mechanism)
Madarame, Haruki; Iida, Masao; Nippon Kikai Gakkai Ronbunshu, B Hen/Transactions of the Japan Society of Mechanical Engineers, Part B; August, 1997; ISSN 0387-5016; Volume 63, no. 612, pp. 2739-2744; In Japanese; Copyright; Avail: Issuing Activity
Jet-flutter is a transverse oscillation of a submerged upward plane water jet impinging directly a free surface. The movement of the impingement point results in additional fluid mass being left on the surface, which does not balance with the momentum

supplied by the jet. The imbalance results in generation of progressing waves and of a surface level gap at the impingement point. The level gap is restored not by the waves progressing laterally but by the vertical motion of the water column. The above model explains well the following two major characteristics of jet-flutter: the frequency corresponds to that of water column oscillation in a partitioned tank with the same water depth, and the oscillation region has a wide range above a certain velocity limit determined by the water depth.

Author (EI)

Flutter; Oscillations; Mathematical Models

19980042310

Mechanism of jet-flutter: Self-induced oscillation of upward plane jet impinging on free surface (1st Report, Streakline of fluttering jet)

Madarame, Haruki; Iida, Masao; Nippon Kikai Gakkai Ronbunshu, B Hen/Transactions of the Japan Society of Mechanical Engineers, Part B; August, 1997; ISSN 0387-5016; Volume 63, no. 612, pp. 2732-2738; In Japanese; Copyright; Avail: Issuing Activity

An upward plane jet, impinging on the free surface of a shallow rectangular tank, oscillated in absence of external periodical force. The frequency and the oscillation conditions were clarified. The position of the surface swelling created by the jet impingement, the pressure difference between the two sides of the jet and the flow velocity on the bottom near the jet inlet were measured, and their phase relation was examined. The fluttering jet was visualized using ink and the displacement was measured using an image processing technique. The jet behavior was simulated well by a simplified model in which the distributed jet velocity was represented by the mean axial and transverse velocities.

Author (EI)

Flutter; Oscillations; Flow Visualization; Pressure Measurement

19980047720

Experimental study of helmet-mounted display attitude and flow cues on rotorcraft hover performance

Bachelder, E. N., MIT, USA; Hansman, R. J., Jr., MIT, USA; 1997; In English; Copyright; Avail: Aeroplus Dispatch

A study was conducted to investigate the use of visual flow and attitude cues as an aid to lateral drift awareness during helicopter flight while using night vision goggles (NVGs). Four displays were compared: (1) NVG display: the baseline display simulating an NVG image of the cockpit and external environment; (2) NVG/Attitude display: NVG image with an overlay of an attitude symbol and a surrounding Earth-referenced wire-frame globe; (3) rate display: an NVG image with an overlay of a flow cue field; and (4) rate/attitude display: an NVG image with the rate and NVG/attitude display overlays. The task objective was to null out lateral rates in the presence of lateral gusts while in a hover (the yaw, longitudinal, and vertical axes of motion were stabilized with an autopilot). This task was conducted in a fixed-based helicopter simulator using a helmet-mounted virtual reality device. Three pilots were used in this preliminary study. The mean rms drift rate error associated with the baseline NVG display was approximately 6 ft/s. The introduction of rate cues reduced this error by a factor of three.

Author (AIAA)

Helmet Mounted Displays; Hovering; Night Flights (Aircraft)

19980047800

Guiding guided missiles

Heigl, Herbert, Germany; Hetzer, Walter; Lenz, Ernst; AeroSpace; Feb. 1998; ISSN 0949-7064, no. 1, pp. 41-46; In English; Copyright; Avail: Aeroplus Dispatch

The most important characteristic of a missile actuator is the dynamic performance at the output. The best performance in this respect is offered by hydraulic systems. But whereas the potential for improving pneumatic and hydraulic systems has largely been exhausted, electromechanical systems can still be pushed to higher performance limits by using more advanced components, new materials, and digital control techniques. Here, electrohydraulic, electromechanical, and electropneumatic actuators, the three commonly used technologies for actuator systems, are examined. New actuator principles for the future are briefly reviewed, with attention given to magnetostrictive, piezoelectric, and memory-metal actuators.

AIAA

Missile Control; Guidance (Motion); Air to Air Missiles; Missile Configurations; Flight Control

Two new techniques for aircraft parameter estimation using neural networks

Raisinghani, S. C., Indian Inst. of Technology, India; Ghosh, A. K., Indian Inst. of Technology, India; Kalra, P. K., Indian Inst. of Technology, India; Aeronautical Journal; Jan. 1998; ISSN 0001-9240; Volume 102,, no. 1011, pp. 25-30; In English; Copyright; Avail: Aeroplus Dispatch

Two new techniques for estimating aircraft stability and control derivatives (parameters) from flight data using feedforward neural networks are proposed. Both techniques use motion variables and control inputs as the input file, while aerodynamic coefficients are presented as the output file for training a neural network. For the purpose of parameter estimation, the trained neural network is presented with a suitably modified input file, and the corresponding predicted output file of aerodynamic coefficients is obtained. Suitable interpretation and manipulation of such input-output files yields the estimated values of the parameters. The methods are validated first on simulated flight data and then on real flight data obtained by digitizing analog data from a published report. Results are presented to show how the accuracy of the estimates is affected by the topology of the network, the number of iterations, and the intensity of the measurement noise in simulated flight data. One of the significant features of the proposed methods is that they do not require guessing of a reasonable set of starting values of the parameters as a popular parameter estimator like the maximum likelihood method does.

Author (AIAA)

Aircraft Control; Stability Derivatives; Parameter Identification; Neural Nets; Feedforward Control; Aerodynamic Coefficients

On the equations of motion for an aircraft with an internal moving load which is then dropped

Bernstein, L., Queen Mary and Westfield College, UK; Aeronautical Journal; Jan. 1998; ISSN 0001-9240; Volume 102,, no. 1011, pp. 9-24; In English; Copyright; Avail: Aeroplus Dispatch

Equations of motion have been developed for the situation in which a substantial load, carried internally by an aircraft, is drawn along a ramp by an extraction parachute and is then dropped. The resulting system of six ordinary differential equations consists of the four normally associated with the longitudinally perturbed motion of the aircraft, together with two describing the motion of the load. Numerical solutions are presented for a generic aircraft, the investigation examining the effects of a number of different parameters such as the ratio of the mass of the load to that of the aircraft, the length and angle of the ramp, the friction between the load and the ramp, and the direction of the parachute extraction force. It was found that the acceleration of the load, relative to the aircraft, was sensibly constant. In the absence of any resetting of the controls (elevators and throttle), the disturbances computed exceeded those for which the linearization is justified. When the controls were reset, either as the load began to move or as it was jettisoned, to the trim values appropriate to the unloaded aircraft flying at the same speed, the disturbances were reduced, but remained large, the phugoid mode being dominant. The incorporation of various kinds of feedback from the disturbance variables to the elevator was also investigated, and a successful control strategy was identified that limited the perturbations and minimized the steady-state errors in airspeed and angle of climb.

Author (AIAA)

Aircraft Stability; Equations of Motion; Aerodynamic Loads; Motion Stability; Airspeed; Feedback Control

Adaptive stabilization of the angular motion of a flight vehicle with analog steering *Adaptivnaya stabilizatsiya uglovogo dvizheniya LA s analogovym rulevym privodom*

Daneev, A. V., Irkutskij Gosudarstvennyj Tekhnicheskij Univ., Russia; Kumenko, A. E., IVVAIU, Russia; Rusanov, V. A., RAN, Irkutskij Vychislitel'nyj Tsentr, Russia; Aviatsionnaya Tekhnika; 1997; ISSN 0579-2975, no. 3, pp. 14-21; In Russian; Copyright; Avail: Aeroplus Dispatch

The paper is concerned with the problem of stabilizing the angular motion of a flight vehicle in the case of substantial nonstationarity of a linearized model of angular dynamics. An approach to the solution of this problem is proposed which is based on a combination of the modal and adaptive control nethods. A procedure for the synthesis of the basic stabilization algorithm is presented.

AIAA

Aircraft Stability; Angular Velocity; Adaptive Control; Motion Stability; Unsteady Aerodynamics

Experimental active control of a typical section using a trailing-edge flap

Vipperman, Jeffrey S., Duke Univ., USA; Clark, Robert L., Duke Univ., USA; Conner, Mark, Duke Univ., USA; Dowell, Earl H., Duke Univ., USA; Journal of Aircraft; Apr. 1998; ISSN 0021-8669; Volume 35, no. 2, pp. 224-229; In English

This paper presents an experimental implementation of an active control system used to suppress flutter in a typical section airfoil. The H2 optimal control system design is based on experimental system identifications of the transfer functions between three measured system variables - pitch, plunge, and flap position - and a single control signal that commands the flap of the airfoil. Closed-loop response of the airfoil demonstrated gust alleviation below the open-loop flutter boundary. In addition, the flutter boundary was extended by 12.4 percent through the application of active control. Cursory robustness tests demonstrate stable control for variations in flow speed of +/-10 percent.

Author (AIAA)

Active Control; Trailing Edges; Flaps (Control Surfaces); Vibration Damping; Control Systems Design; H-2 Control

Thrust offset effect on longitudinal dynamic stability

Bloy, A. W., Manchester, Victoria Univ., UK; Journal of Aircraft; Apr. 1998; ISSN 0021-8669; Volume 35, no. 2, pp. 343, 344; In English; Copyright; Avail: Aeroplus Dispatch

In order to gain a better understanding of thrust effects, dynamic stability is considered by solving linearized longitudinal equations of motion. Thrust effect is shown to indirectly affect dynamic stability through its influence on an aerodynamic derivative. to a first approximation, high- or low-thrust lines do not affect the longitudinal short-period oscillation with a positive maneuver margin required for stability. The phugoid oscillation, however, is adversely affected by a low-thrust line with the phugoid damping reduced. In the case of a constant thrust jet aircraft flying above the minimum drag speed and neglecting compressibility effects, the condition for neutral stability is derived.

AIAA

Dynamic Stability; Aircraft Stability; Thrust; Flight Tests; Pitching Moments

Sensitivity of open-loop typical section gust response to structural parameters

Layton, Jeffrey B., Clarkson Univ., USA; Journal of Aircraft; Apr. 1998; ISSN 0021-8669; Volume 35, no. 2, pp. 341-343; In English; Copyright; Avail: Aeroplus Dispatch

The rms response of a typical section model subjected to a gust is examined using the state covariance matrix. The sensitivity of the rms behavior with respect to several aeroelastic parameters is investigated in order to gain an understanding of the passive aeroelastic stability augmentation design for gust alleviation. As a result of the characterization of the gust response sensitivity, the usefulness of the state covariance matrix for passive tailoring for gust response is demonstrated.

AIAA

Gust Alleviators; Aerodynamic Loads; Sensitivity; Structural Design

Forebody flow control for extended high-angle-of-attack maneuvers

Hodgkin, F., Bath, Univ., UK; Wood, N. J., Manchester, Victoria Univ., UK; Journal of Aircraft; Apr. 1998; ISSN 0021-8669; Volume 35, no. 2, pp. 212-217; In English; Copyright; Avail: Aeroplus Dispatch

Tangential forebody blowing for the purpose of yaw control has been investigated on a six percent generic fighter model in the 2.1 x 1.5 m low-speed wind tunnel at the University of Bath. Force and moment data were obtained from a sting-mounted, six-component strain gauge balance over an angle-of-attack range of -10 to 120 deg. The tangential blowing slots were incorporated into a vacuum-formed, plastic forebody, which contained two independent plenum chambers. The geometry of the slots was optimized for high-angle-of-attack operation based on results from previous research. Three different forebodies were used to investigate the effects of different azimuthal slot positions. At angles of attack beyond 60 deg, all of the slot locations were shown to produce significant yawing moments, even when compared to conventional yaw control at low angles. This control moment did not decay at the maximum angle of attack tested, which suggests that the envelope of control could be extended farther. The concept remained effective even at conditions where the flow along the longitudinal body axis was reversed. At angles of attack appropriate for normal cruise operation, takeoff, or landing, all slot locations proved effective in producing yawing moments. Consequently, tangential forebody blowing may prove capable of replacing conventional fin and rudder combinations in establishing weathercock stability.

Author (AIAA)

Forebodies; Angle of Attack; Aircraft Maneuvers; Fighter Aircraft; Low Speed Wind Tunnels

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tubes; and aircraft engine test stands.

19980041298 Army Aeromedical Research Lab., Fort Rucker, AL USA
Spatial Disorientation Awareness Training Scenarios for US Army Aviators in Visual Flight Simulators
Jan. 1998; 51p; In English
Contract(s)/Grant(s): DA Proj. 301-62787-A-879
Report No.(s): AD-A336474; USAARL-98-17; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
     Spatial disorientation (SD) remains an important source of attrition in military flying. SD was considered to be a significant factor in 291 (30 percent) of Class A-C helicopter accidents in the U.S. Army during an 8 year period between 1987 and 1995. The monetary cost of SD is high and the fatality rate is between one and one half to two times that of non-disorientation accidents. One method of reducing the impact of SD is through enhanced awareness and training of aviators. It is not possible to demonstrate many of the disorienting circumstances safely during actual flight. It can, however, be safely and effectively demonstrated in a visual flight simulator. Actual SD accident summaries from the U.S. Army Safety Center (USASC) were reviewed and those accidents which could reasonably be replicated in a visual simulator were selected. The resulting visual simulator scenarios are used to train aviators to recognize, avoid and overcome SD. In addition, the scenarios provide training to assist aviators in overcoming SD once encountered. Other, yet equal, benefits from this method of training are the reinforcement of aircrew coordination elements and the development of decision-making, risk assessment, and judgement skills.
DTIC
Visual Perception; Visual Acuity; Visual Flight; Helicopters; Flight Simulators

19980041410 Actidyne S.A., La Garenne, France
Centrifuges and Simulators *Final Report*
Perdriat, Jacques, Actidyne S.A., France; Dec. 1997; 6p; In English
Contract(s)/Grant(s): N68171-96-C-9010
Report No.(s): AD-A335530; R/D-7867-EN-01; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
     The WES civil engineering centrifuge designed and built by Acutronic France, shall be, when commissioned not only the world strongest ever built centrifuge but also the world most performing centrifuge in its size in terms of maximum acceleration. The installation, commissioning, and scientific investigation of this unique system was contracted to Actidyn SA, a company formed by the former design team of the centrifuge, on November 13, 1995.
DTIC
Structural Engineering; Centrifuges

19980045763 Science Applications International Corp., Arlington, VA USA
Six Heliport Case Studies *Final Report*
Peisen, D. J., Science Applications International Corp., USA; Winick, R. M., Winick (Robert M.), USA; Berardo, S. V., Hoyle, Tanner and Associates, USA; Ferguson, S. W., EMA, USA; Nov. 1997; 144p; In English
Report No.(s): PB98-119878; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
     This report evaluates the dynamics of heliport development and operation in order to achieve greater success rate in the future through the case study investigation of six heliports that have both succeeded and failed. The heliports studied are: Houston Central Business District Heliport, Houston Texas; E.34th Street Heliport, New York, New York; Garland HeliPlex, Garland, Texas; Annapolis Heliport, Annapolis, Maryland; Boston City Heliport, Boston, Massachusetts; and Cobo Hall Heliport, Detroit, Michigan.
NTIS
Heliports; Airport Planning; Rotary Wing Aircraft

19980046578 Auburn Univ., AL USA
Analysis Supporting MSFC Cryostat Testing Unit *Final Report*
Foster, Winfred A., Jr., Auburn Univ., USA; Jenkins, Rhonald M., Auburn Univ., USA; Apr. 01, 1997; 60p; In English
Contract(s)/Grant(s): NAS8-39131
Report No.(s): NASA/CR-205197; NAS 1.26:205197; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report summarizes the results obtained from an analysis of the NASA Marshall Spaceflight Center (MSFC) cryostat testing unit. A finite element model was generated to determine both temperature distribution and stress distribution in the cryostat testing unit for load conditions supplied by MSFC. This report contains the results of that analysis.

Author

Temperature Distribution; Finite Element Method; Stress Distribution; Cryostats; Mathematical Models; Test Facilities

19980046923

Going dutch

Lewis, Alan; Concrete (London); July-August, 1997; ISSN 0010-5317; Volume 31, no. 7, pp. 12-14; In English; Copyright; Avail: Issuing Activity

The use of concrete block paving in the Netherlands is discussed. The advantages offered by concrete block paving are outlined. One apparent drawback of concrete block paving is its high labor demand. In the Netherlands, this has been overcome for much routine reinstatement work by the use of mechanical, or rather semi-mechanical, systems.

EI

Concretes; Construction; Pavements; Economics; Airports

19980047114 NASA Langley Research Center, Hampton, VA USA

Hyper-X Wind Tunnel Program

McClinton, C. R., NASA Langley Research Center, USA; Holland, S. D., NASA Langley Research Center, USA; Rock, K. E., NASA Langley Research Center, USA; Engelund, W. C., NASA Langley Research Center, USA; Voland, R. T., NASA Langley Research Center, USA; Huebner, L. D., NASA Langley Research Center, USA; Roger, R. C., NASA Langley Research Center, USA; 1998; 18p; In English; Aerospace Sciences Meeting and Exhibit, 12-15 Jan. 1998, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): NASA/TM-1998-207317; NAS 1.15:207317; AIAA Paper 98-0553; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper provides an overview of NASA's focused hypersonic technology program, called the Hyper-X Program. The Hyper-X Program, a joint NASA Langley and Dryden program, is designed to move hypersonic, air breathing vehicle technology from the laboratory environment to the flight environment, the last stage preceding prototype development. The Hyper-X research vehicle will provide the first ever opportunity to obtain data on an airframe integrated scramjet (supersonic combustion ramjet) propulsion system at true flight conditions and the first opportunity for flight validation of experimental wind tunnel, numerical and analytical methods used for design of these vehicles. A substantial portion of the program is experimentally based, both for database development and performance validation. The program is now concentrating on Mach 7 vehicle development, verification and validation and flight test risk reduction. This paper concentrates on the aerodynamic and propulsion experimental programs. Wind tunnel testing of the flight engine and complete airframe integrated scramjet configuration flow-path is expected in 1998 and 1999, respectively, and flight test is planned for 2000.

Author

Supersonic Combustion Ramjet Engines; Research Vehicles; Hypersonic Vehicles; Flight Tests; Transatmospheric Vehicles

19980047903

Nondestructive testing of airport concrete structures - Runways, taxiways, roads, bridges, and building walls and roofs

Weil, Gary J., EnTech Engineering, Inc., USA; 1997, pp. 18-29; In English; Copyright; Avail: Aeroplus Dispatch

Maintenance of airport infrastructure presents many challenges. Airport engineering/maintenance personnel must maintain infrastructure that includes runways, taxiways, roadways, walkways, bridges, building walls and roofs. Presently only a limited number of accurate and economical techniques exist to test concrete structures for integrity and safety as well as insure that they meet original design specifications. Remote sensing, nondestructive testing techniques, such as IR thermography, ground penetrating radar, magnetometers, and pachometers, measure physical properties affected by the various materials and conditions found within, and under, concrete infrastructure. These techniques have established reputations for accurate investigations of concrete anomalies.

Author (AIAA)

Nondestructive Tests; Airports; Runway Conditions; Roads; Bridges; Buildings

19980047904

Nondestructive evaluation of frost-heave effects on a runway

Lenngren, Carl A., Swedish National Road Administration, Sweden; 1997, pp. 2-17; In English; Copyright; Avail: Aeroplus Dispatch

An airport located inland in central Sweden is susceptible to frost heave. The runway is uneven, especially at the end of each winter. The Swedish Road and Transportation Institute Laser Profiler was brought to the site in the spring of 1997 in order to study this seasonal effect. Several longitudinal profiles were sampled along the entire length of the runway. The test was then repeated in the fall when the runway had settled. The profiles were then investigated to see if certain criteria were fulfilled, like the ICAO straight edge guideline. Several different wavelength intervals of unevenness were also examined. It was found that the frost heave affected certain wavelength bands more than others. It was also possible to determine exactly where the most troublesome spots were located, and if they would adversely interfere with an expansion of the runway. Data from the profiler could also serve in preparing guidelines for safety rules related to roughness.

Author (AIAA)

Nondestructive Tests; Runway Conditions; Frost; Profilometers; Laser Applications

19980047924

Changing training

Leonhard, Raimund; Defence Helicopter; Mar. 1998; ISSN 0963-116X; Volume 17, no. 1, pp. 14-16, 18; In English; Copyright; Avail: Aeroplus Dispatch

The German Army's Aviation Branch has undertaken a comprehensive modification of its training practices in anticipation of the entry into active service of the Tiger and NH-90 helicopters, which employ 'glass cockpits' and fly-by-wire control. The current, 30-year-old training system will be replaced by the Integrated Learning and Training system, encompassing a flight simulator and the new Eurocopter EC 135 training helicopter.

AIAA

Military Operations; Pilot Training; Military Helicopters; Training Evaluation; Cockpits

19980048238

Estimation of wind from airplane states in coordinated flight

Katz, Amnon, Alabama, Univ., Tuscaloosa, USA; Sharma, Manu, Alabama, Univ., Tuscaloosa; Journal of Aircraft; Apr. 1998; ISSN 0021-8669; Volume 35, no. 2, pp. 191-196; In English

Contract(s)/Grant(s): N61339-91-D-0001; MDA903-93-C-0161; Copyright; Avail: Aeroplus Dispatch

A filter is defined that extracts the wind aloft from the Earth velocity and the orientation of a flight vehicle in coordinated flight (data that are available in the context of distributed interactive simulation). A convergence theorem is proved stating that the estimated wind monotonically approaches the true wind when the latter is horizontal and constant. The filter builds the transverse component of the wind and converges to the full wind as the flight vehicle changes heading. The fastest convergence occurs when the filter is applied at heading intervals equal to a critical interval that depends on the bank.

Author (AIAA)

Wind Measurement; Earth Rotation; Flight Vehicles

19980048747

Making T5 virtually perfect

Baldwin, Bernie; Aerospace International; Mar. 1998; ISSN 0305-0831; Volume 25, no. 3, pp. 24-27; In English; Copyright; Avail: Aeroplus Dispatch

The paper reports on how GKN Westland System Assessment Ltd (WSAL) is helping to ensure that the Heathrow Terminal 5 (T5) operates to a maximum efficiency from the very beginning of operations. On the request of British Airways, in its role as the proposed main user of T5, WSAL is to propose a solution with which to model parts of the operation of the building and maximize its effectiveness. The principal aspects of the modeling project are reviewed.

AIAA

Airports; England; Cost Effectiveness; Terminal Facilities

10
ASTRONAUTICS

Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; space communications, spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

19980041304 George Washington Univ., Joint Inst. for Advancement of Flight Sciences, Hampton, VA USA
Aerothermodynamics of the Mars Global Surveyor Spacecraft
Shane, Russell W., George Washington Univ., USA; Tolson, Robert H., George Washington Univ., USA; Mar. 1998; 104p; In English
Contract(s)/Grant(s): NCC1-104; RTOP 242-80-01-01
Report No.(s): NASA/CR-1998-206941; NAS 1.26:206941; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

   The aerothermodynamics characteristics of the Mars Global Surveyor spacecraft are investigated and reported. These results have been used by the Mars Global Surveyor mission planners to design the aerobraking phase of the mission. Analytical and Direct Simulation Monte Carlo computer codes were used with a detailed, three dimensional model of the spacecraft to evaluate spacecraft aerobraking characteristics for flight in free molecular and transitional flow regimes. The spacecraft is found to be aerodynamically stable in aerobraking and planned contingency configurations. Aerodynamic forces, moments, and heating are found to be highly dependent on atmospheric density. Accommodation coefficient. is seen to strongly influence drag coefficient. Transitional flow effects are found to reduce overall solar panel heating. Attitude control thruster plumes are shown to interact with the freestream, diminishing the effectiveness of the attitude control system and even leading to thrust reversal. These plume-freestream interaction effects are found to be highly dependent on freestream density.
Author
Aerothermodynamics; Transition Flow; Monte Carlo Method; Three Dimensional Models; Aerodynamic Heating; Aerodynamic Stability

19980048872

Methods for the design of highly maneuverable landers. II *Metody proektirovaniya vysokomanevrennykh spuskaemykh letatel'nykh apparatov. II.*
Afanas'ev, V. A., GRTs 'KB im. ak. V. P. Makeeva', Russia; Meshchanov, A. S., Kazanskij Gosudarstvennyj Tekhnicheskij Univ.-Kazanskij Aviatsionnyj Inst., Russia; Sirazetdinov, T. K., Kazanskij Gosudarstvennyj Tekhnicheskij Univ.-Kazanskij Aviatsionnyj Inst., Russia; Aviatsionnaya Tekhnika; 1997; ISSN 0579-2975, no. 3, pp. 9-13; In Russian; Copyright; Avail: Aeroplus Dispatch

   New methods are proposed for designing highly maneuverable axisymmetric conical spacecraft operating at large self-balanced angles of attack. Methods are presented for determining the lift and drag coefficients, aerodynamic design parameters, maneuver duration, and initial conditions of atmospheric entry. These methods allow for the constraints on the terminal state of the spacecraft and on the current values of the angle of attack and its derivative while maximizing the maneuver efficiency functional. The solutions presented here ensure the stability of the maneuver over a finite period of time with and without allowance for the external (wind) and parametric preturbations.
AIAA
Spacecraft Design; Spacecraft Maneuvers; Drag Coefficients; Spacecraft Landing; Aerodynamic Characteristics

11
CHEMISTRY AND MATERIALS

Includes chemistry and materials (general); composite materials; inorganic and physical chemistry; metallic materials; nonmetallic materials; propellants and fuels; and materials processing.

19980041311 Wright Lab., Aero Propulsion and Power Directorate, Wright-Patterson AFB, OH USA
COBRA 2 Correlation Study and Field Performance Summary *Final Report, Jul. - Oct. 1997*
Wright, Robert, Jr., Wright Lab., USA; Nov. 1997; 34p; In English
Contract(s)/Grant(s): AF Proj. 3048
Report No.(s): AD-A337597; WL-TR-97-2097; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

   A correlation study of the complete oil breakdown rate analyzer, version II (COBRA II) was undertaken to determine the approximate repeatability and reproducibility of data from these oil analysis instruments. Simple root mean square (RMS) equa-

tions were used to calculate these parameters. The COBRA II monitors the level of thermal degradation in synthetic, ester-based turbine engine oils. The 95% confidence levels for repeatability and reproducibility were less than 5% and 12% RMS, respectively. The performance of the COBRA II was found to be acceptable and very similar to the repeatability and reproducibility of data from typical Joint Oil Analysis Program (JOAP) atomic emission spectrometers. Additionally, a summary of the field performance to date of the COBRA 2 is included. The COBRA 2 has helped to save at least 13 US Air Force turbine engines from oil system (bearing) failure, amounting to savings of about $39M and a 17,000% return on investment. COBRA II appears to be a very good analytical tool for use in turbine engine maintenance programs where significant oil thermal degradation problems may exist.
DTIC
Lubricating Oils; Turbine Engines; Thermal Degradation; Mean Square Values

19980041447 General Electric Co., Schenectady, NY USA
Turbulence-Chemistry Models in Highly Strained Non-Premixed Flames *Final Report, 1 Sep. 1994 - 30 Nov. 1997*
Correa, Sanjay M., General Electric Co., USA; Hu, Iris Z., General Electric Co., USA; Jan. 30, 1998; 64p; In English
Contract(s)/Grant(s): F49620-94-C-0020; AF Proj. 2308
Report No.(s): AD-A337370; AFRL-SR-BL-TR-98-0162; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
    To allow implementation of chemical kinetic schemes of arbitrary complexity in computational design codes for gas-turbine combustion, a new microstructural turbulent combustion model was developed. The fine structure of turbulent combustion was represented by PSR (Perfectly Stirred Reactor) theory. The theory is the intense-combustion analog of flamelet theory. Residence times in the PSR were related to the scalar dissipation, and turbulence-chemistry interactions were closed by using the probability distribution function for scalar dissipation in a turbulent flow. Calculations compared very favorably with Raman data on temperature and species from three turbulent bluff-body stabilized laboratory flames: (i) a non-premixed $CO/H2/N2$-air flame, (ii) a non-premixed $CH4/H2$-air flame, and (iii) a premixed $CH4$-air flame. With this success, the model was applied to two practical combustors: (iv) an axially-staged combustion system which produces about half the NOx of a conventional combustor while offering greater operability, and operates in an unusual regime of turbulence-chemistry interactions, and (v) a conventional aircraft engine combustor. In the latter case, a kinetic scheme with over 121 species and 996 elementary reactions was demonstrated. In both cases, the calculated results agreed well with temperature and species data. The physical model developed here was use d directly in the industry-standard pressure-corrected mean Navier-Stokes/assumed-shape pdf/k-epsilon type of CFD code, which affords significant geometric flexibility and rapid convergence for gas-turbine combustor flowfields.
DTIC
Aircraft Engines; Turbulent Flow; Turbulent Combustion; Turbulence Models; Microstructure

19980046572 United Technologies Corp., East Hartford, CT USA
Applications of Endothermic Reaction Technology to the High Speed Civil Transport *Final Report, Jul. 1995 - Mar. 1997*
Glickstein, Marvin R., Pratt and Whitney Aircraft, USA; Spadaccini, Louis J., United Technologies Corp., USA; Apr. 1998; 9p; In English
Contract(s)/Grant(s): NAS3-27397
Report No.(s): NASA/CR-207404; NAS 1.26:207404; UTRC-R97-5.101.0037-5/19; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
    The success of strategies for controlling emissions and enhancing performance in High Speed Research applications may be Increased by more effective utilization of the heat sink afforded by the fuel in the vehicle thermal management system. This study quantifies the potential benefits associated with the use of supercritical preheating and endothermic cracking of let fuel prior to combustion to enhance the thermal management capabilities of the propulsion systems in the High Speed Civil Transport (HSCT). A fuel-cooled thermal management system, consisting of plate-fin heat exchangers and a small auxiliary compressor, is defined for the HSCT, Integrated with the engine, and an assessment of the effect on engine performance, weight, and operating cost is performed. The analysis indicates significant savings due a projected improvement in fuel economy, and the potential for additional benefit if the cycle is modified to take full advantage of all the heat sink available in the fuel.
Author
Heat Budget; Thermodynamic Properties; Fuel Combustion; Heat Exchangers; Temperature Control; Endothermic Fuels; Endothermic Reactions; Supersonic Transports; Propulsion System Performance

Development and testing of a chemical mechanism for the evaluation of the effect of subsonic aircraft on the upper troposphere

Stockwell, William R., Fraunhofer-Inst. fuer Atmosphaerische Umweltforschung, Garmisch-Partenkirchen, Germany; Kuhn, Michael, Fraunhofer-Inst. fuer Atmosphaerische Umweltforschung, Garmisch-Partenkirchen, Germany; Seidl, Winfred, Fraunhofer-Inst. fuer Atmosphaerische Umweltforschung, Garmisch-Partenkirchen, Germany; Klemm, Otto, Bayreuth, Univ., Germany; Pollutants from air traffic - Results of atmospheric research 1992-1997; 1997, pp. 135-144; In English; Copyright; Avail: Aeroplus Dispatch

The Regional Atmospheric Chemistry Mechanism (RACM) was developed for the modeling of atmospheric chemistry. We investigated the importance of HO radical production from sulfate particles and concluded that this process is relatively unimportant. The RACM mechanism was incorporated into a box model. to test the mechanism the box model was used to model several aircraft exhaust plumes from recent aircraft measurements. The measured photolysis frequencies for the photolysis of ozone to produce O1D appeared to be anomalously high when compared with the model results, but the (NO)/(NO(y)) ratios were reasonably well fit by the model. The box model was used to model several scenarios which are based upon the results of Schlager et al. (1997) and other recent aircraft measurements. The calculations were performed for a range of upper troposphere conditions to estimate if ozone formation is NO(x)- or volatile organic compound (VOC)-limited in the present atmosphere. The mixtures were run with varying amounts of initial NO(x) or VOCs, and the maximum changes in ozone mixing ratios were determined. The response of the atmosphere is highly nonlinear, so the upper atmosphere can be either NO(x)-limited or VOC-limited depending on the conditions. The most ozone was produced for the case containing the greatest amount of added NO(x) and VOCs.
Author (AIAA)
Subsonic Aircraft; Troposphere; Ozone; Nitrogen Oxides

Microphysical, chemical, and dynamical processes in aircraft plumes

Kaercher, Bernd, DLR, Inst. fuer Physik der Atmosphaere, Oberpfaffenhofen; Muenchen, Univ., Germany; Hirschberg, Michaela, Muenchen, Univ., Germany; Fabian, Peter, Muenchen, Univ., Germany; Pollutants from air traffic - Results of atmospheric research 1992-1997; 1997, pp. 113-122; In English; Copyright; Avail: Aeroplus Dispatch

A theoretical investigation of microphysical and chemical processes in aircraft exhaust plumes during the first stages of wake dispersion is presented. A suitable computational model has been developed to describe the 2D turbulent mixing of a single jet of exhaust gas from aircraft engines with the atmosphere. The model has been used to work out general features of transport and conversion of exhaust effluents. It has also been employed to study the conditions in the jet that lead to the formation of ice contrails. The model has been extended to include a set of all relevant chemical reactions in the gas phase and to study the chemical conversion of exhaust species with regard to the specific fluid dynamical conditions of the jet regime. A trajectory box model has been developed that is driven by turbulent mixing rates from the 2D jet model, and by parameterized mixing rates at later stages of wake dispersion.
Author (AIAA)
Plumes; Exhaust Gases; Aircraft Engines; Aircraft Wakes; Turbulent Mixing

12
ENGINEERING

Includes engineering (general); communications and radar; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.

NERAC, Inc., Tolland, CT USA

Aircraft Antennas. (Latest citations from the INSPEC Database)
Feb. 1998; In English
Report No.(s): PB98-852601; Copyright Waived; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The bibliography contains citations concerning the design and applications of aircraft antennas in communications, navigation, radar, and landing systems. The citations explore radiation pattern calculations and measurements, antenna couplings, jam-

ming problems, conformal arrays, microstrip antennas, and phased array aircraft antennas.(Contains 50-250 citations and includes a subject term index and title list.)
NTIS
Bibliographies; Aircraft Antennas

19980041335 Air Force Inst. of Tech., Graduate School of Engineering, Wright-Patterson AFB, OH USA
Velocity Profiles and Skin Friction on a Ribletted Flat Plate in Adverse Pressure Gradient
Branam, Richard D., Air Force Inst. of Tech., USA; Dec. 1997; 179p; In English
Report No.(s): AD-A336654; AFIT/GAE/ENY/97D-01; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche
    This project investigated the flow field characteristics over a flat, ribletted plate and the effects of an adverse pressure gradient on this flow field. Testing examined the development of the flow over the ribletted plate from laminar through fully turbulent flow fields. The flow field states (laminar, transitional, and turbulent) were determined using local turbulence intensity values and boundary layer profiles. Several parameters were examined to help better describe the flow characteristics, boundary layer profiles, and influence on skin friction drag. The skin friction drag coefficients were calculated using a numerical integration technique to determine an average value and scaled to the platform area of the plate to compare results with smooth plate values. Although the geometry and flow conditions produced a drag augmenting case, skin friction followed trends described by the other flow parameters; streamwise velocity, Reynolds stress, etc. At locations where the boundary layer developed in the riblet valley, the skin friction was higher. As the flow developed to transitional and fully turbulent, higher values were also experienced. For the zero pressure gradient and mild adverse pressure gradient, counter rotating vortices developed in the riblet valley. This more organized motion also had slightly reduced skin friction below the transitional flow field for the plate as well.
DTIC
Aerodynamic Coefficients; Aerodynamic Drag; Boundary Layer Control; Boundary Layers; Flat Plates; Flow Characteristics; Flow Distribution; Numerical Integration; Pressure Gradients; Reynolds Stress; Riblets; Skin Friction; Transition Flow; Turbulence; Turbulent Flow

19980041828

Improving the accuracy of the rotor resistance estimate for vector-controlled induction machines
Wade, S., Heriot-Watt Univ., UK; Dunnigan, M. W.; Williams, B. W.; IEE Proceedings: Electric Power Applications; September, 1997; ISSN 1350-2352; Volume 144, no. 5, pp. 285-294; In English; Copyright; Avail: Issuing Activity
    The estimation of rotor resistance in a vector-controlled induction machine is necessary to achieve high performance torque control. The extended Kalman filter (EKF) or the extended Luenberger observer (ELO) have been used to estimate this machine parameter. Three techniques are presented for use with the EKF and ELO which improve the accuracy of the rotor resistance estimate, either in both estimators, or in the EKF alone. These techniques are: the use of the synchronous two-axis (d(sub e)-q(sub e)) frame model of the induction machine with the EKF, the inclusion of the core loss resistance to precalculate the phase currents used by the estimators, and the injection of a high frequency sine wave on the flux current reference command. These improvements are achieved without increasing the complexity of the estimation algorithms. The consequent improvements in the rotor resistance estimation are illustrated through simulation and practical implementation of a vector-controlled induction machine. A high performance digital signal processor (DSP) is used in the practical implementation.
Author (EI)
Digital Systems; Kalman Filters; Signal Analyzers; Signal Processing; Synchronism; Rotors; Winding; Electrical Resistance; Parameter Identification; Mathematical Models

19980041829

Effect of skew, pole count and slot count on brushless motor radial force, cogging torque and back EMF
Hanselman, D. C., Univ. of Maine, USA; IEE Proceedings: Electric Power Applications; September, 1997; ISSN 1350-2352; Volume 144, no. 5, pp. 325-330; In English; Copyright; Avail: Issuing Activity
    Permanent magnet brushless motors are increasingly being used in high performance applications. In many of these applications the acoustic noise and torque ripple characteristics of the motor are of primary concern. Because of this concern, it is important to understand the influence of the motor geometrical parameters of skew amount, pole count and slot count on the resulting motor characteristics of radial force, cogging torque and back EMF. While these relationships are understood intuitively and have been explored experimentally and predicted numerically, they have not been confirmed analytically for motors having any combination of skew amount, pole count and slot count. The paper fills this void by exploring these relationships analytically using a Fourier series. The influence of skew amount, pole count and slot count on motor radial force, cogging torque and back EMF

are shown to confirm prior experimental and numerical results. More importantly, the derived analytical results provide valuable insight into the implications of common motor design choices.

Author (EI)

Electromotive Forces; Fourier Series; Permanent Magnets; Electric Motors; Torque; Noise (Sound); Rotors; Winding; Stators

19980042181

Model H(sub infinity) control of flexible rotor supported by magnetic bearings

Hayashi, Hiroyuki; Saito, Takashi; Shinoda, Yoshihiko; Okada, Yohji; Nippon Kikai Gakkai Ronbunshu, C Hen/Transactions of the Japan Society of Mechanical Engineers, Part C; August, 1997; ISSN 0387-5024; Volume 63, no. 612, pp. 2725-2730; In Japanese; Copyright; Avail: Issuing Activity

Robust H(sub infinity) control of a flexible rotor supported by magnetic bearings is described. It is aimed at stabilization of a flexible rotor which runs over the bending critical speed. Both ends of the rotor are supported by magnetic bearings which are controlled by a local PD controller, The stiffness of the bearings needs to be high so that the vibration in the bending modes becomes less damped with increasing feedback gains. Additional sensors are installed for measurement of the bending modes and the modal PD controller is used to reduce the higher peaks. However, since spillover instability occurs in the system by using the modal controller, a modal H(sub infinity) controller is used to avoid spillover instability. The results show a high probability of reduction of the lower bending vibration and robustness to the higher peaks.

Author (EI)

Magnetic Bearings; Rotors; Optimal Control; Robustness (Mathematics); Control; Digital Systems

19980042247

Predominance of resonance in expansion-cavity-type muffler with flow (2nd report, generalization of predominance phenomena of tail pipe resonance)

Liu, B.; Oka, T.; Mikami, M.; Kojima, N.; Nippon Kikai Gakkai Ronbunshu, B Hen/Transactions of the Japan Society of Mechanical Engineers, Part B; July, 1997; ISSN 0387-5016; Volume 63, no. 611, pp. 2500-2506; In Mixed; Copyright; Avail: Issuing Activity

Predominant resonance can occur in flow-induced noise from an expansion-cavity-type muffler for particular combinations of muffler configuration and flow velocity. This phenomenon is caused by self-excited oscillation based on the feedback response from acoustic resonances of the muffler to shear flow. Usually, the sound pressure level is much higher when predominance of tail pipe resonance rather than cavity resonance occurs. The predominance of tail pipe resonance is shown to be strongly influenced by both the frequency characteristics of acoustic amplification of the tail pipe and the frequency of velocity fluctuation with a certain phase criterion. The predominance phenomena can be generalized using a new dimensionless independent variable, $(L/l')(1/M)$, where L, l' and M are cavity length, acoustically equivalent tail pipe length and Mach number in the tail pipe, respectively.

Author (EI)

Pipes (Tubes); Mufflers; Noise (Sound); Noise Reduction; Resonators; Sound Generators; Aerodynamics

19980042253

Prediction method for condensation heat transfer coefficient of pure refrigerants in horizontal micro-fin tubes

Shikazono, N.; Itoh, M.; Uchida, M.; Fukushima, T.; Hatada, T.; Nippon Kikai Gakkai Ronbunshu, B Hen/Transactions of the Japan Society of Mechanical Engineers, Part B; July, 1997; ISSN 0387-5016; Volume 63, no. 611, pp. 2436-2443; In Mixed; Copyright; Avail: Issuing Activity

The condensation heat transfer coefficients of pure refrigerants in horizontal micro-fin tubes were predicted by solving the modeled equations. In the model, film condensation on the inner fins was estimated from the total unwetted area, while the forced convection condensation heat transfer coefficient of the liquid film was set to be equal to that of the smooth tube. The predicted results showed good agreement with the experimental results, and it was shown that effects of the parameters that characterize the micro-fin tube, i. e., pipe diameter, fin height, fin pitch and fin tip angle, were well predicted. Furthermore, the high heat transfer coefficient was reproduced in the high-quality range using the present model, which assumes that the liquid phase is distributed in the valley between the grooves in this region.

Author (EI)

Heat Transfer Coefficients; Prediction Analysis Techniques; Refrigerants; Fins; Heat Transfer; Mathematical Models

Design and fabrication of surface micromachined micromotors with large dimensions

Kraus, Th., Technical Univ. of Berlin, Germany; Baltzer, M.; Obermeier, E.; Journal of Micromechanics and Microengineering; September, 1997; ISSN 0960-1317; Volume 7, no. 3, pp. 196-199; In English; Copyright; Avail: Issuing Activity

Micromotors with enlarged 800 micron and 1200 micron rotor diameters are described in this paper. A large driving torque was obtained by fabricating up to 234 stator and 156 rotor electrodes. Microbridges were used to connect the stator electrodes to the electrical lines and two different electrode designs were investigated. The most favourable electrode geometry and the driving torque was determined by simulating the force per pole. The surface micromachined micromotors have been fabricated and tested successfully.

Author (EI)

Motors; Electromechanical Devices; Micromachining; Stators; Rotors

Fabrication of high aspect ratio silicon microstructures by anodic etching

Charlton, M. D. B., Univ. of Southampton, UK; Parker, G. J.; Journal of Micromechanics and Microengineering; September, 1997; ISSN 0960-1317; Volume 7, no. 3, pp. 155-158; In English; Copyright; Avail: Issuing Activity

We describe a refinement of the anodization process commonly used for the formation of porous silicon, which allows the fabrication of arrays of very high aspect ratio sub-micron pores and free-standing pillars. These structures are shown to possess a wide photonic band gap in the near infra red.

Author (EI)

High Aspect Ratio; Electromechanical Devices; Silicon; Etching; Aspect Ratio; Energy Gaps (Solid State)

Simple optical system to optimize a high depth to width aspect ratio applied to a positive photoresist lithography process

Conedera, V., Cent. Natl. de la Recherche Scientifique, France; Fabre, N.; Dilhan, M.; Journal of Micromechanics and Microengineering; September, 1997; ISSN 0960-1317; Volume 7, no. 3, pp. 118-120; In English; Copyright; Avail: Issuing Activity

The fabrication of micro electro mechanical systems by electrodeposition inside resist moulds has provided much interest in recent years. In this paper, we propose a method to optimize the lithography process of a thick positive photoresist. This technique is based on the variation of transparency of the photoresist during exposure. During exposure the absorption of the light-sensitive compound decreases due to its conversion into indene carboxylic acid. A very good aspect ratio (height:width) of up to 10:1 and high edge steepness (88 deg) has been obtained from one coat and one UV exposure.

Author (EI)

High Aspect Ratio; Electromechanical Devices; Optical Equipment; Optimization; Electromagnetic Absorption

Measurements of air change rates and air flow patterns in large single-cell buildings

Said, M. N. A., Inst. for Research in Construction, Canada; Energy and Buildings; September, 1997; ISSN 0378-7788; Volume 26, no. 2, pp. 175-182; In English; Copyright; Avail: Issuing Activity

This paper describes the measurements of the air change rates and air flow patterns in two large single-cell aircraft hangar buildings. The decay of the tracer gas sulfur hexafluoride was used to measure the air change rates. It was possible to achieve a uniform mixture of indoor air and the tracer gas in the hangars using the air circulation fans of the heating system. Stratified air layers characterized the air flow patterns within the hangars. For the test conditions, measured air change rates for the two hangars are in the range 0.32 to 0.47 air changes per hour. Results also suggest that five sampling locations at about 1.8 m (6 ft) height are sufficient to obtain a representative air change rate for large single-cell buildings.

EI

Air Flow; Flow Distribution; Hangars; Ventilation; Air Purification; Experiment Design

Estimation of speed, stator temperature and rotor temperature in cage induction motor drive using the extended Kalman filter algorithm

Al-Tayie, J. K., Univ. of Newcastle, UK; Acarnley, P. P.; IEE Proceedings: Electric Power Applications; September, 1997; ISSN 1350-2352; Volume 144, no. 5, pp. 301-309; In English; Copyright; Avail: Issuing Activity

Application of the extended Kalman filter (EKF) algorithm to the estimation of speed, stator temperature and rotor temperature in induction motor drives is described. The estimation technique is based on a closed-loop observer that incorporates mathe-

matical models of the electrical, mechanical and thermal processes occurring within the induction motor. Speed and temperature estimation is independent of the drive's operating mode, though closed-loop estimation is possible only if stator currents are non-zero. The EKF algorithm used to perform the estimation process has been implemented using a TMS320C30 digital signal processor and experimental results demonstrate the effectiveness of the new estimation algorithm.

Author (EI)

Digital Systems; Induction Motors; Kalman Filters; Signal Analyzers; Signal Processing; Stators; Rotors; Winding; Temperature; Velocity

19980043214

Minimising rotor losses in high-speed high-power permanent magnet synchronous generators with rectifier load

van der Veen, J. L. F., Eindhoven Univ. of Technology, Netherlands; Offringa, L. J. J.; Vandenput, A. J. A.; IEE Proceedings: Electric Power Applications; September, 1997; ISSN 1350-2352; Volume 144, no. 5, pp. 331-337; In English; Copyright; Avail: Issuing Activity

In an early stage of the design of a high-speed 1400kW synchronous generator with permanent magnet excitation and loaded by a rectifier, it became apparent that rotor losses are a major problem. The stator currents cause asynchronous components in the air-gap field. Analysis shows that a modified polyphase system reduces the number of these components. An approximate solution for the rotor losses caused by the asynchronous field components has been derived. The formulae show the effects of machine dimensions and harmonics and the effect of a conducting shield in the rotor. The main purpose of the study is to have a tool for making an early choice among several stator winding configurations. A modified nine-phase system, combined with a shield around the permanent magnet rotor, is a prospective option.

Author (EI)

Electric Generators; High Speed; Loads (Forces); Permanent Magnets; AC Generators; Rotors; Winding; Energy Dissipation; Stators

19980043333

Stability of the rotor supported in gas journal bearings with a chamber feeding system

Czolczynski, K., Technical Univ. of Lodz, Poland; Wear; September, 1997; ISSN 0043-1648; Volume 210, no. 1-2, pp. 220-236; In English; Copyright; Avail: Issuing Activity

This paper describes the results of numerical investigations of the stability problem of the rigid symmetrical rotor supported in two externally pressurized gas journal bearings. The bushes of the bearings are mounted on a system of linear springs and viscous dampers. When the stiffness and damping coefficients of these springs and dampers are chosen correctly, it is possible to avoid the self-excited vibrations of the rotor. Such vibrations, which are caused by the phenomenon of a half-synchronic whirl, are the major obstacle to the widespread application of gas bearings. The results of authors numerical experiments have shown that the elastic support of the bearing bushes can be designed as an additional externally pressurized air ring, surrounding the bush. The set of parameters of such a ring is optimal when the bearing has a chamber feeding system.

Author (EI)

Gas Bearings; Journal Bearings; Rotors; Vibration Damping; Damping; Springs (Elastic)

19980043478

Ultrasonic stress evaluation in a compressor rotor

Bray, Don E., Texas A&M Univ., USA; Tang, Wei; Grewal, Dilawar S.; Journal of Testing & Evaluation; September, 1997; ISSN 0090-3973; Volume 25, no. 5, pp. 503-509; In English; Copyright; Avail: Issuing Activity

The run-out report for a compressor rotor showed an almost continuous bow between the two bearings. The maximum run-out of 0.03 mm (0.0012 in.) occurred at the inlet to the fourth stage impeller. The steel compressor rotor was just over 3 m in length. It had been removed from service for maintenance. Each of the seven compressor stages was mounted on the rotor at the time of the stress measurement. An evaluation of the residual stress at the inlet locations in the shaft using critically refracted longitudinal, L(sub CR), ultrasonic waves showed compressive stress on the bowed side of the rotor, supporting the conclusion that residual stress is the cause of the bow.

Author (EI)

Compressor Rotors; Stress Measurement; Rotors; Compressors; Bearings; Residual Stress; Refraction; Ultrasonics

19980043722

Mathematically modeling technique for nonlinear vibrations of rotors

Chen, Anhua, XMI, China; Zhong, Jue; Xiangtan Kuangye Xueyuan Xuebao/Journal of Xiangtan Mining Institute; June, 1997;

Linear differential equations obtained by general identification and modeling techniques can't be used to analyze qualitatively and quantitatively actual vibration behavior of rotors when nonlinearities exist evidently in rotor systems. A new technique for identifying and modeling rotor systems has been presented in this paper. Mathematical operations and programming for it are relatively simple. It doesn't require specially designed excitations, so can be applied to practice conveniently. The present technique is proved to be effective through mathematically modeling a real rotor.
Author (EI)
Rotor Dynamics; Rotors; Mathematical Models; Vibration Mode; System Identification; Mathematical Programming

19980044655

Comprehensive measurements of the intermittency exponent in high Reynolds number turbulent flows

Praskovsky, Alexander, Natl. Cent. for Atmospheric Research, USA; Oncley, Steven; Fluid Dynamics Research; November, 1997; ISSN 0169-5983; Volume 21, no. 5, pp. 331-358; In English; Copyright; Avail: Issuing Activity

The intermittency exponent mu is determined from comprehensive measurements in the mixing layer (R(sub lambda) approximately = 2.0 x 10(sup 3)) and in the return channel (R(sub lambda) approximately = 3.2 x 10(sup 3)) of a large wind tunnel as wellspheric surface layer at R(sub lambda) approximately = (3.3-12.7) x 10(sup 3). to estimate the value of mu and its dependence on R(sub lambda) and the flow conditions, different methods of data processing are applied to the same data base, i.e., mus defined by its scaling behavior in the inertial range of centered and non-centered correlation functions and spectra of energy dissipation, second order moments of epsilon(sub r) and lnepsilon(sub r), etc. (Here R(sub lambda) is the Taylor microscale based Reynolds number, and epsilon(sub r) is the energy dissipation averaged over a segment of length r.) It is found that these methods do not define a unique value of mu but a set of different scaling exponents, and these exponents stay systematically different over the range of flow conditions which was studied. No tendency for these exponents to collapse is observed up to R(sub lambda) = 12.7 x 10(sup 3).
Author (EI)
Flow Velocity; High Reynolds Number; Reynolds Number; Turbulent Flow; Wind Tunnels; Channel Flow; Correlation

19980046111

Noise and vibration control for HVAC and piping systems

Yerges, James F., Yerges Acoustical, USA; Yerges, John R.; HPAC Heating, Piping, Air Conditioning; October, 1997; ISSN 0017-940X; Volume 69, no. 10, pp. 44-47; In English; Copyright; Avail: Issuing Activity

Noise and vibration control for building mechanical systems is a subject that is still being dealt with today. This article offers engineering advice on how to avoid noise and vibration problems through good mechanical engineering design and strategic communication with other members of the construction team.
EI
Aerodynamic Noise; Air Conditioning; Fan Blades; Noise Reduction; Space Heating (Buildings); Vibration Damping; Technical Writing; Vibration Mode; Noise (Sound)

19980047517

Velocity structure functions in a turbulent plane jet

Pearson, B. R., Newcastle, Univ., Australia; Antonia, R. A., Newcastle, Univ., Australia; 1997, pp. P3-117 to P3-121; In English; Copyright; Avail: Aeroplus Dispatch

Measurements have been made of moments, up to order eight, of the longitudinal velocity increment delta u on the centerline of a turbulent plane jet in the self-preserving region of the flow. Measurements of both delta u and delta v (where v is the lateral velocity fluctuation) were made at R(lambda) = 600. The IR (inertial range) scaling exponents of delta v are significantly smaller than those of delta u. The departure from isotropy in the inertial range is also discussed.
Author (AIAA)
Turbulent Jets; Flow Velocity; Wind Tunnels; Nozzle Geometry

19980047523

Modeling of turbulent swirling flows

Shih, Tsang-Hsing, NASA Lewis Research Center, USA; Zhu, Jiang, NASA Lewis Research Center, USA; Liou, William W., NASA Lewis Research Center, USA; Chen, Kuo-Huey, Toledo, Univ., USA; Lumley, John L., Cornell Univ., USA; 1997, pp. 31-1 to 31-6; In English; Copyright; Avail: Aeroplus Dispatch

This paper is devoted to a development of a cubic Reynolds stress-strain model for turbulent swirling flows, inspired by the work of Launder's (1995) group at UMIST. Using this type of model, one only needs to solve two turbulence equations, one for turbulent kinetic energy and the other for dissipation rate. The cubic model developed in this paper is based on a general Reynolds stress-strain relationship. Two flows have been chosen for model evaluation. One is a fully developed rotating pipe flow, and the other is a more complex flow with swirl and recirculation.

Author (AIAA)

Turbulent Flow; Swirling; Aircraft Engines; Combustion Chambers; Reynolds Stress; Computational Fluid Dynamics

19980047528

Complex time series modeling and analysis for rotor dynamics identification

Lee, C. -W., Korea Advanced Inst. of Science and Technology, Republic of Korea; Park, J. -P.; Kim, K. -J.; Journal of Vibration and Acoustics, Transactions of the ASME; October, 1997; ISSN 1048-9002; Volume 119, no. 4, pp. 512-522; In English; Copyright; Avail: Issuing Activity

A new time series method, directional ARMAX (dARMAX) model-based approach, is proposed for rotor dynamics identification. The dARMAX processes complex-valued signals, utilizing the complex modal testing theory which enables the separation of the backward and forward modes in the two-sided frequency domain and makes effective modal parameter identification possible, to account for the dynamic characteristics inherent in rotating machinery. The dARMAX is superior in nature to the conventional ARMAX particularly in the estimation of the modal parameters for isotropic and weakly anisotropic rotors. Numerical simulations are performed to demonstrate effectiveness of the dARMAX.

Author (EI)

Rotor Dynamics; Time Series Analysis; Rotors; Rotation; Mathematical Models

19980047553

Effects of blowing/suction from a spanwise slot on a turbulent boundary layer flow

Choi, H., Seoul National Univ., Republic of Korea; Park, J., Seoul National Univ., Republic of Korea; Hahn, S., Seoul National Univ., Republic of Korea; 1997, pp. P1-37 to P1-42; In English; Copyright; Avail: Aeroplus Dispatch

Effects of uniform blowing/suction from a spanwise slot on a turbulent boundary layer are investigated using the direct numerical simulation technique. Even though the magnitude of blowing/suction is very small, it significantly changes the skin friction as well as the streamwise vortex above the wall. In the case of uniform blowing, the skin friction on the slot is significantly decreased. Streamwise vortices above the wall are lifted up by blowing, and thus the interaction of the vortices with the wall is reduced. Therefore, the lifted vortices become stronger, resulting in increased turbulence intensity as well as skin friction downstream of the slot. The opposite effects are observed in the case of uniform suction.

Author (AIAA)

Turbulent Boundary Layer; Blowing; Suction; Boundary Layer Flow; Skin Friction; Wing Slots

19980047559

Calculation of gas turbine combustor flows using an adaptive grid redistribution method

Jones, W. P., Imperial College of Science, Technology and Medicine, UK; Menzies, K. R., Rolls-Royce, PLC, UK; 1997, pp. 3-25 to 3-30; In English; Copyright; Avail: Aeroplus Dispatch

A 3D adaptive grid redistribution scheme is described and applied to the calculation of the reacting flow in a gas turbine combustion chamber. The adaptive grid method is coupled to a 3D flow solver employing the k-epsilon turbulence model and a conserved scalar description of combustion. The results of the calculations on different grid sizes are shown and are compared to measurements. The adaptive grid scheme is shown to improve the results of the calculations by reducing numerical errors.

Author (AIAA)

Gas Turbine Engines; Combustion Chambers; Reacting Flow; Three Dimensional Flow

19980047562

A new low-Re non-linear two-equation turbulence model for complex flows

Apsley, David D., UMIST, UK; Leschziner, Michael A., UMIST, UK; 1997, pp. 6-25 to 6-30; In English; Copyright; Avail: Aeroplus Dispatch

A new low-Re, nonlinear k-epsilon turbulence model is proposed and tested. The stress-strain relationship is derived by the iterative solution of an algebraic stress model. Truncation of the process at the third iteration yields a stress-strain relationship which is cubic in the mean-velocity gradients and circumvents the singular behavior which afflicts the exact solution at large strains. Free coefficients are calibrated - as functions of y* - by reference to DNS data for a channel flow, and are extended to

non-equilibrium conditions by consideration of their P/epsilon dependence. The model performance is investigated for two 2D separated flows.

Author (AIAA)

K-Epsilon Turbulence Model; Low Reynolds Number; Reynolds Stress; Airfoil Profiles; Velocity Distribution

19980047574

Computation of film cooling by lateral injection using a multi-block technique

Lakehal, D., Karlsruhe, Univ., Germany; Theodoridis, G. S., Karlsruhe, Univ., Germany; Rodi, W., Karlsruhe, Univ., Germany; 1997, pp. 3-13 to 3-18; In English; Copyright; Avail: Aeroplus Dispatch

The film-cooling effectiveness of a flat plate by a row of laterally injected jets is investigated using a Navier-Stokes equation solver which employs a finite-volume method with a multiblock technique. The paper compares measured and calculated temperature and velocity fields obtained with the k-epsilon-based two-layer-turbulence model for various blowing rates. The resolution of the viscosity-affected near-wall region with a one-equation turbulence model yielded a noticeable improvement in the prediction of film-cooling effectiveness compared to results obtained with wall functions. Furtheremore, results of additional calculations using the ad hoc correction proposed by Bergeles et al. (1978), which attempts to promote the lateral diffusivity, combined with the two-layer model indicate that this anisotropy correction indeed enhances the spanwise spreading, but its application very close to the wall needs additional calibration.

Author (AIAA)

Film Cooling; Flat Plates; Jet Flow; Finite Volume Method; Turbulence Models; Aircraft Engines

19980047592

Assessment of nondestructive evaluation needs for ageing corporate and private aircraft

Reinhart, Eugene R., Reinhart and Associates, Inc., USA; 1997, pp. 278-285; In English; Copyright; Avail: Aeroplus Dispatch

Considerable attention has been focused on the life extension of ageing military and commercial aircraft by the government and major aircraft fabricators. A vital, but often neglected segment of the aircraft industry is the area of inspecting ageing fleets of corporate and privately-owned afteraft. Many of these aircraft are inspected and maintained by the various FAA-approved repair stations located around the country. Nondestructive inspection (NDI) methods, equipment, and trained inspectors are a key aspect of maintaining these aircraft however, there are currently several issues that need to be addressed by the private sector NDI community. Personnel training and certification to an accepted standard is critically needed in this industry since experience and capability in NDI can vary considerably between FAA stations and inspectors. Also, the updating of NDI methods and standards is needed. A review of these issues and suggestions for improvement are presented.

Author (AIAA)

Nondestructive Tests; General Aviation Aircraft

19980047603

The use of solid film highlighter in automation of D Sight image interpretation

Forsyth, D. S., National Research Council of Canada, Inst. for Aerospace Research, Ottawa, Canada; Komorowski, J. P., National Research Council of Canada, Inst. for Aerospace Research, Ottawa; Gould, R. W., National Research Council of Canada, Inst. for Aerospace Research, Ottawa; 1997, pp. 50-56; In English; Copyright; Avail: Aeroplus Dispatch

Many studies have shown inspector variability to be a crucial parameter in nondestructive evaluation (NDE) reliability. It is desirable to automate the decision making process in NDE as much as possible; automation of inspection data handling and interpretation will also enable use of data fusion algorithms currently being researched for increasing inspection reliability via combination of different NDE modes. Enhanced visual inspection techniques such as D Sight (double pass retroreflection) have the ability to rapidly inspect lap splice joints in transport aircraft for corrosion. Automated interpretation of D Sight images is being developed to maximize inspection reliability. This requires that variability in surface reflectivity due to paint, contaminants, and dirt be eliminated or controlled. In a method of applying a solid film to a surface before optical inspections, the film conforms to the surface, preserving topographical information while maintaining constant reflectivity. These conditions allow for the development of metrics for quantitative corrosion measurement in aircraft lap splice joints using D Sight and other optical methods. Different metrics suitable for automated interpretation have been developed and tested on inspections of actual service-retired aircraft specimens using D Sight with solid film highlighter.

Author (AIAA)

Automation; Image Analysis; Nondestructive Tests; Corrosion; Aircraft Structures

Damage identification and location on a typical aeronautical structure

Napolitano, Luca, Naples, Univ., Italy; Fedele, Paolo, Napoli II, Univ., Italy; Viscardi, Massimo, Naples, Univ., Italy; Lecce, Leonardo, Naples, Univ., Italy; 1997, pp. 100-106; In English; Copyright; Avail: Aeroplus Dispatch

A technique for detecting and locating structural damages is presented in this paper. It is based on the analysis of experimentally evaluated Frequency Response Functions (FRFs), and consists of a comparison of the FRFs of the healthy structure which are assumed as reference and the FRFs collected at different times. A damage detection index interprets the differences between the FRFs. The results obtained by this technique when tested on a partial frame of a commercial aircraft were very interesting. It was possible to detect and locate all damages which were simulated/induced and also gave an indication of the extent of the damage. Moreover, the technique has the basic features reqnired of a new NDE technique such as being nonmodel-related and having the possibility of performing real-time monitoring.
Author (AIAA)

Aircraft Structures; Damage; Nondestructive Tests

Phase unwrapping for flaw detection - Is it necessary?

Bard, Benjamin A., Pennsylvania State Univ., University Park, USA; 1997, pp. 168-178; In English; Copyright; Avail: Aeroplus Dispatch

The phase-stepping technique is becoming a common enhancement to digital shearography and holography systems used in NDE. Capturing a series of phase-stepped images, rather than just a pair, allows the calculation of surface deformation at every pixel; data form an equispaced, spatially dense set rather than a sparse collection of nonuniformly spaced points. Phase maps are calculated modulo 2(pi). If surface deformations are of sufficiently high amplitude, the phase will appear 'wrapped'. The next logical step is to 'unwrap' the phase and make it continuous again. For flaw detection purposes, however, this difficult step should be questioned; it is sometimes not only unnecessary, but deleterious to the flaw detection process. Further image processing steps must sometimes be applied to the unwrapped phase in order to expose flaws once readily visible in the wrapped phase map. These steps, only applicable to an unwrapped phase map, can also serve to uncover some flaws not previously visible in the wrapped phase map. Finally, effective data visualization plays an important role in conveying information embedded in the wrapped or unwrapped phase maps. This paper introduces these issues and gives several examples, wrapped and unwrapped, with varying excitation type, composite material, flaw type, and image processing.
Author (AIAA)

Shearography; Nondestructive Tests; Defects; Skin (Structural Member); Wings

The monitoring of crack growth beneath a bonded repair using Bragg gratings

McKenzie, I., Monash Univ., Australia; Jones, R., Monash Univ., Australia; Chiu, W. K., Monash Univ., Australia; Booth, D., Victoria Univ. of Technology, Australia; Galea, S., DSTO, Australia; 1997, pp. 272-283; In English; Copyright; Avail: Aeroplus Dispatch

In the aircraft industry the use of externally bonded composite repairs has become an accepted way of repairing fatigue, or corrosion, damaged metallic structural components. Optical fibers offer a means of monitoring the load transfer process in these repairs, and can therefore be used to provide an indication of the integrity of the repair. We describe the use of an array of Fiber Bragg Grating strain sensors (FBGs) for the in situ monitoring of bonded repairs to aircraft structures and, in particular, the monitoring of crack propagation beneath a repair. The FBGs have been multiplexed using a combination of wavelength and spatial techniques employing a tunable Fabry-Perot filter to track individual gratings. The multiplexed FBGs were then surface mounted on a boron-epoxy unidirectional composite patch bonded to an Al component. The sensors were located so as to monitor the changing stress field associated with the propagation of a crack beneath the patch. The ability of relating experimental results to sensor readings is then confirmed using both a thermoelastic scan of the patch and 3D finite element analysis. The relative merits of surface bonding verses embedding sensors are discussed, and a standardized embedding procedure for fiber optic sensors in boron-epoxy patches is described.
Author (AIAA)

Bragg Gratings; Crack Propagation; Aircraft Maintenance; Boron-Epoxy Composites

Modelling of extra-compressibility terms in high speed turbulent flows

Lejeune, Christine, Toulouse, Inst. de Mecanique des Fluides, France; Kourta, Azzedine, Toulouse, Inst. de Mecanique des Flui-

des, France; 1997, pp. P3-71 to P3-76; In English; Copyright; Avail: Aeroplus Dispatch

This paper deals with the development of turbulence models for high speed turbulent flows. Special attention is devoted to the pressure-dilatation correlation Pi(d) that represents an important contribution of dilatational effects on the turbulent kinetic energy budget. The modelling of this term is based on linear acoustics. A simple order-of-magnitude analysis, including isentropic hypothesis for the thermodynamic properties of the fluid permits to deduce an algebraic expression for Pi(d). A modified turbulence model including extracompressibility terms is finally tested on a supersonic mixing layer with a convective Mach number varying from 0.2 to 1.0. Our numerical results are in good agreement with the experimental data from other authors.
Author (AIAA)
Compressible Flow; Turbulent Flow; Turbulence Models; Hypersonic Aircraft; Flow Velocity; Mixing Layers (Fluids)

19980047894
Thermal wave imaging of defects in fiber-reinforced composites
Favro, Lawrence D., Wayne State Univ., USA; Han, Xiaoyan, Wayne State Univ., USA; Thomas, Robert L., Wayne State Univ., USA; 1997, pp. 129-134; In English
Contract(s)/Grant(s): F49620-93-1-0428; Copyright; Avail: Aeroplus Dispatch

The principles of thermal wave imaging for NDE are described. The technique uses high-power photographic flash lamps for pulse-heating of the surface of the composite. The cooling of the surface is monitored by means of an IR video camera. Disbonds, delaminations, and inclusions are seen in the thermal wave images, with deeper features appearing systematically at later times. Examples of the application of thermal wave imaging to nondestructive evaluation of boron fiber composite reinforcement patches, and graphite-fiber aerospace composite materials are described.
Author (AIAA)
Infrared Imagery; Fiber Composites; Nondestructive Tests; Spacecraft Structures; Aircraft Structures

19980047895
An overview of vibrational-based nondestructive evaluation techniques
Shen, Ji Y., North Carolina Agricultural and Technical State Univ., Greensboro, USA; Sharpe, Lonnie, Jr., North Carolina Agricultural and Technical State Univ., Greensboro; Jankovsky, Amy L., NASA Lewis Research Center, USA; 1997, pp. 117-128; In English; Copyright; Avail: Aeroplus Dispatch

Nondestructive damage detection is an important issue in aerospace/aeronautical structures. The use of vibration-based nondestructive evaluation (NDE) techniques to locate structural damage has been attempted in aircraft and large space structures. In an attempt to develop a structural health monitoring system for rocket engines, hundreds of papers on vibrational assessment have been reviewed. We provide a comprehensive overview of various vibrational-based NDE techniques, including a brief introduction of the theoretical background of different methods, an analysis of their advantages and drawbacks, and a foretaste of the applications of different methods towards different type of structures. Many of these methods have been tested using mass-spring test models or simple planar truss models. Few standard test problems truly embrace the essence of real-world structures, and are as such poor judges of the performance of a few method.
Author (AIAA)
Structural Vibration; Nondestructive Tests; Spacecraft Structures; Aircraft Structures

19980047898
A perturbation solution for the interaction of Lamb waves with localized surface defects
El-Azab, A., California, Univ., Los Angeles, USA; Mal, Ajit K., California, Univ., Los Angeles; 1997, pp. 76-86; In English
Contract(s)/Grant(s): F49620-93-1-0320; Copyright; Avail: Aeroplus Dispatch

We present an analytical solution of the transmitted and reflected wave fields due to the interaction of Lamb waves with localized, small-scale defects (e.g., corrosion pits) on plate surfaces. The surface defect is represented by a distribution of surface sources, and the overall solution is obtained as a superposition of the incident wave field plus the 'small' wave field associated with the surface sources. The reflection and transmission coefficients of various Lamb modes are also determined. It is shown that the scattered (perturbation) field consists of a superposition of various possible modes at the frequency of the incident mode. For the fundamental modes, it is found that the reflection coefficients are periodic functions of the defect width, with the period and magnitude being dependent on the surface defect profile. The transmission coefficient for the converted mode is also found to be a periodic function of the defect width, while that corresponding to the incident mode does not deviate significantly from

unity. A parametric study has also shown that to this approximation the numerical values of the reflection and transmission coefficients are not sensitive to the maximum slope of the defect profile.

Author (AIAA)

Lamb Waves; Wave Interaction; Surface Defects; Wave Scattering; Corrosion; Aircraft Structures

19980047900

NDI method to locate intergranular corrosion around fastener holes in aluminum wing skins

Rutherford, Paul S., Boeing Co., USA; 1997, pp. 57-67; In English

Contract(s)/Grant(s): F34601-88-C-1080; Copyright; Avail: Aeroplus Dispatch

Contact between galvanically dissimilar metals, such as cadmium plated steel fasteners and aluminum wing skins are known to be a source of corrosion. If a void exists between the fastener head and the aluminum skin, moisture can collect and intergranular corrosion may occur along aluminum grain boundaries, which run parallel to the surface of the wing skin. If intergranular corrosion is allowed to propagate, delamination of the thin layers of aluminum, or 'exfoliation corrosion', will occur. When this intergranular corrosion reaches an exfoliated state, extensive rework is involved in removing the corrosion. This paper discusses the results of an USAF E-3A Engineering Service Task to develop a nondestructive inspection procedure to detect intergranular corrosion in an incipient state before it reaches exfoliation. Eddy current and ultrasonic inspection techniques were evaluated. A novel ultrasonic pulse echo technique was developed which uses a focus transducer with a hand-held fixture. Inspections were performed on test parts which were removed from the upper wing skin of a retired 707 which had varying degrees of intergranular and exfoliation corrosion. Inspection results are compared to the results from the mechanical rework of the wing skin and dissection of a wing skin fastener hole.

Author (AIAA)

Nondestructive Tests; Intergranular Corrosion; Fasteners; Aluminum Alloys; Skin (Structural Member); Wings

19980047901

Low-frequency magnetoresistive eddy-current sensors for NDE of aging aircraft

Boltz, E. S., TPL, Inc., USA; Cutler, D. W., TPL, Inc., USA; Tiernan, T. C., TPL, Inc., USA; 1997, pp. 39-49; In English; Copyright; Avail: Aeroplus Dispatch

Life extensions on numerous military and commercial aircraft have heightened the need for quantitative, nondestructive detection of deeply buried damage in aircraft structures. Traditional coil-based eddy-current sensors are severely limited in their ability to detect small buried defects, defects under fasteners and deeply buried cracks and corrosion. We have developed eddy current sensors based on the use of giant magnetoresistance (GMR) sensor elements. GMR offers high sensitivity, very wide bandwidth and low noise from dc to over 1 GHz. Coupled with the ability to fabricate GMR sensors with micron-level dimensions, these new eddy-current sensors offer an ideal technology for inspections requiring high spatial resolution and LF, deeply-penetrating fields. This paper discusses magnetoresistance and results obtained using a prototype GMR sensor for both contacting and noncontacting, C-scan measurements on samples containing crack and corrosion damage.

Author (AIAA)

Low Frequencies; Magnetostriction; Eddy Currents; Nondestructive Tests; Aircraft Structures

19980047902

Detection and imaging of corrosion around wing skin fasteners using the dripless bubbler ultrasonic scanner

Hsu, David K., Iowa State Univ., Ames, USA; Barnard, Daniel J., Iowa State Univ., Ames; 1997, pp. 32-38; In English; Copyright; Avail: Aeroplus Dispatch

The galvanic action between steel fasteners and aluminum wing skins of aircraft often leads to hidden exfoliation corrosion around the countersink surface of the fastener heads. to detect and evaluate the severity of such corrosion defects, the Dripless Bubbler ultrasonic scanner was applied. This technique uses a focused beam of high frequency (15 MHz) ultrasound in a closed-cycle, water-coupled scan of wing skin test panels (typically 0.190 to 0.230-inch thick) containing corroded and uncorroded fasteners. With full waveform acquisition, not only the lateral extent but also the depth profile of the corrosions around the fastener heads were mapped out, subject to shadowing of defects at different depth. The technique is capable of providing quantitative assessment of the severity of the corrosion. In tests conducted to evaluate different techniques, the Dripless Bubbler has shown high probability of detection and low false call rate. The presence of paint on the surface did not degrade the performance of the technique. In addition, the Dripless Bubbler was also used on wing skin panels containing repair 'blendout' regions that had 0.020

to 0.100 inch of metal removed from the surface by grinding. Corrosions around fasteners in the blend-out regions were also detected.
Author (AIAA)
Ultrasonic Flaw Detection; Corrosion; Fasteners; Wings; Skin (Structural Member)

Test benches for ceramic components for automobile gas turbines
Avran, Patrick, ONERA, France; Leclair, Alain, Peugeot-Citroen, France; Payen, Gerard, Renault, France; ONERA, TP no. 1997-69; 1997; In English
Report No.(s): ONERA, TP no. 1997-69; Copyright; Avail: Aeroplus Dispatch
    The first part of this paper describes a test facility adapted to characterize the catalytic combustor. The combustion chamber is a LPP combustor (Lean Premixed Prevaporized), made of preheater, premix duct, catalytic part, and afterburner. Each component will be validated separately for the required conditions. All the measurements and acquisition data are described. The second part deals with a test facility for hot spin testing of the ceramic wheel. The base of the test bench is a modified turbocharger. With this configuration it will be possible to test the ceramic radial wheel within the AGATA specifications; in this case the compressor is used like a break. The last part is devoted to ceramic heat exchanger test rigs: the first one in order to evaluate the thermomechanical stresses on the samples and the second one to assess the performance compared to the AGATA specifications and to restitute the transient and thermal shock conditions. In this program the heat exchanger is fixed.
Author (AIAA)
Test Facilities; Ceramics; Gas Turbines; Superchargers; Turbocompressors; Automobile Engines

The detection of interlaminar corrosion in rivetted thin aluminum skins
Geng, Q., Windsor, Univ., Canada; North, W., Windsor, Univ., Canada; 1997, pp. 256-262; In English; Copyright; Avail: Aeroplus Dispatch
    The fuselage of an aircraft is made by rivetting thin aluminum skins to the substructure, which is then exposed to the elements. Moisture can penetrate between these aluminum surfaces causing interlaminar corrosion. This research describes an optical procedure to inspect large areas of quasi-flat surfaces in order to identify areas of suspected interlaminar corrosion, followed by a focussed ultrasonic test in the suspected area to confirm the interlaminar corrosion. After a contour scan of the offending area to determine the resulting contour amplitude, a FEA model of the area was used to estimate the stress in the aluminum skin.
Author (AIAA)
Skin (Structural Member); Rivets; Fuselages; Corrosion; Inspection

Modeling shallow-spherical-shell piezoceramic actuators as acoustic boundary control elements
Jayachandran, V., Delaware, Univ., Newark, USA; Sun, J. Q., Delaware, Univ., Newark; Smart Materials and Structures; Feb. 1998; ISSN 0964-1726; Volume 7,, no. 1, pp. 72-84; In English
Contract(s)/Grant(s): NSF CMS-96-34672; Copyright; Avail: Aeroplus Dispatch
    There has been a growing interest in the active suppression of noise in aircraft interiors. While there are already many different technical solutions available in the form of active noise controllers using loudspeakers and structural sources, there is a need for low-profile acoustic sources that could be used for generating large volume velocities with high efficiency and low control effort. This paper presents an investigation into the potential use of shallow-spherical-shell actuators (also known as RAINBOW actuators), made of piezoelectric materials supported on a flexible foundation along the edge, for such applications. The actuators have been modeled analytically, and the effects of curvature, mount stiffness, mass, and other parameters on the natural frequencies, linear stroke, and volume velocity have been studied. Simulation results are presented, and the potential for using the actuator as an efficient acoustic source is discussed.
Author (AIAA)
Shallow Shells; Aircraft Noise; Noise Reduction; Acoustic Excitation; Active Control

Joint field of integrated fibre optic sensors for aircraft and spacecraft safety parameters monitoring
Pol'skii, Yuri E., Kazan State Technical Univ., Russia; Morozov, Oleg G., Kazan State Technical Univ., Russia; 1997, pp. 217-223; In English; Copyright; Avail: Aeroplus Dispatch

Development trends of on-board fiber optic systems for safety-parameter monitoring of aerospace transport facilities are considered. The concept of a joint field of integrated fiber-optic sensors is incorporated and possibilities for on-board system creation with improved metrological and information features, based on field advantages, are discussed. Questions of optical reflectometry applications for information removal from sensors in the field are considered, and constructive particularities of the latter are determined. Applications of sensors based on two twisted fibers with locked ends in amplitude, polarimetric, and reflectometric measuring transducers are discussed.

Author (AIAA)

Multisensor Applications; Fiber Optics; Aircraft Safety; Aerospace Safety; Space Transportation; In-Flight Monitoring

19980047993

Automatic shearography inspection system for helicopter rotor blades

Walz, Thomas, Ettemeyer GmbH, Germany; Ettemeyer, Andreas, Ettemeyer GmbH, Germany; 1997, pp. 187-192; In English; Copyright; Avail: Aeroplus Dispatch

Helicopter rotor blades are highly sophisticated products composed of a variety of materials and components. They are safety-relevant components and therefore, 100 percent quality control has to be assured. Eurocopter has installed a system for automatic and 100 percent inspection of rotor blades on structural defects in which laser shearography is used as an inspection technique. The rotor blades are mounted in a vacuum chamber and loaded with a relative pressure difference. At this load, bonding and structural defects show up as tiny deformations of the surface and are recorded with two shearography cameras, positioned on both sides of the rotor blade. After each measurement, they are automatically moved to the next inspection position. In this way, the entire rotor blade is automatically inspected in several measuring steps. As this helicopter blade inspection system is the first automatic production control system based on laser shearography in Europe, this application is an important step in bringing shearography techniques into production control.

Author (AIAA)

Shearography; Rotary Wings; Nondestructive Tests; Composite Materials; Automatic Control

19980047994

Holographic analysis of the structural and operational dynamics of an advanced graphite-epoxy composite flight control structure

Fein, Howard, Polaris Research Group, USA; 1997, pp. 179-186; In English; Copyright; Avail: Aeroplus Dispatch

Holographic interferometry (HI) has been successfully employed to characterize the materials and behavior of diverse types of structures under stress. Specialized variations of this technology have also been applied to define dynamic and vibration-related structural behavior. Structures and materials can be analyzed with very low amplitude excitation, and the resulting data can be used to adjust the accuracy of mathematically derived structural models, aiding the primary engineering of advanced graphite-epoxy fiber composite materials for use in aircraft, missile, and smart weapon control structure applications that must consider extremes in vibration and mechanical stresses. These are ideal requisites for analysis using advanced holographic methods in the initial design and subsequent test of such advanced components. Holographic techniques are definitive in their identification of vibrational modes, displacements, and motion geometries. Such effects are directly indicative of various types of induced mechanical, thermal, and acoustic structural stress related to hidden structural anomalies and defects. Deriving such information can be crucial to the determination of mechanical configurations and designs, as well as critical operational parameters of advanced engineering material structures.

Author (AIAA)

Holographic Interferometry; Graphite-Epoxy Composites; Flight Control; Nondestructive Tests; Modal Response; Vibration Measurement

19980047995

A real-time portable phase-stepping shearography system for NDE

Lu, Guowen, Pennsylvania State Univ., University Park, USA; Bard, Benjamin, Pennsylvania State Univ., University Park; Wu, Shudong, Pennsylvania State Univ., University Park; 1997, pp. 156-167; In English; Copyright; Avail: Aeroplus Dispatch

Shearography has been shown to be a powerful tool for on-site nondestructive evaluation (NDE) applications, especially in aircraft component inspections. However, current commercially available portable shearography systems are qualitative, low S/N, and low flaw detection sensitivity. In this paper, we will introduce a real-time, high-resolution, portable, phase-stepping shearography system developed at Pennsylvania State University. The system can fit into a wheeled cart and run at a speed of 1-2 inspections/sec for a 7 x 5-inch field of view; it provides full quantitative analysis ability, and substantially improves flaw detection

sensitivity. The applicability and portability of the system to on-site field NDE applications have been tested by a successful field demonstration conducted at a naval air station.

Author (AIAA)

Real Time Operation; Shearography; Nondestructive Tests; Aircraft Structures

19980048056
Energy absorption of composite plates and tubes

Dubey, Dean D., Maryland, Univ., College Park, USA; Vizzini, Anthony J., Maryland, Univ., College Park; Journal of Composite Materials; 1998; ISSN 0021-9983; Volume 32, no. 2, pp. 158-176; In English

Contract(s)/Grant(s): DAAH04-93-G-0001; Copyright; Avail: Aeroplus Dispatch

A total of 28 graphite/epoxy flat-plate specimens and six graphite/epoxy tube specimens were crushed under quasi-static conditions to provide a basis for comparison of the measured energy absorbency of these two geometries. The energy absorbency of each specimen was measured, and the specific sustained crushing stress was determined. All plate and tube specimens were manufactured from AS4/3501-6 graphite/epoxy with the same layup and thickness, thus providing a common laminate for comparison. Flat-plate specimens of two different widths were tested to determine the effect of the testing fixture on the observed energy absorbency. The flat-plate results indicate that the specific energy absorbency per unit thickness is nearly independent of the specimen width, with a small contribution to the energy absorbency by the testing fixture. However, this calculated value of measured energy absorption due to the test fixture is within the scatter of the data. The results also indicate that specimen geometry affects specimen stability and therefore the failure modes exhibited by the specimen during crushing. Flat-plate specimens can be used as a lower-cost alternative to tube specimens or in test programs requiring simpler geometries.

Author (AIAA)

Energy Absorption; Graphite-Epoxy Composites; Flat Plates; Aircraft Structures; Crushing

19980048084
Static aeroelastic effects on a transonic indicial response wing flutter calculation

Kolonay, R. M., USAF, Research Lab., USA; Yang, Henry T. Y., California, Univ., Santa Barbara; Journal of Aircraft; Apr. 1998; ISSN 0021-8669; Volume 35, no. 2, pp. 339-341; In English

Report No.(s): AIAA Paper 96-3983; Copyright; Avail: Aeroplus Dispatch

A method is proposed for including static aeroelastic effects in a transonic indicial response fing flutter analysis. The method uses static aeroelastic equilibrium states as aerodynamic surface boundary conditions when performing indicial responses. In the example considered here, the inclusion of static aeroelastic effects is shown to reduce the difference between the indicial response flutter dynamic pressure and the time integration flutter dynamic pressure from 7 to 0.1 percent.

AIAA

Aeroelasticity; Wing Oscillations; Transonic Flutter; Fighter Aircraft; Flutter Analysis; Unsteady Aerodynamics

19980048088
Composite patches as reinforcements and crack arrestors in aircraft structures

Lena, M. R., Purdue Univ., USA; Klug, J. C., Purdue Univ., USA; Sun, C. T., Purdue Univ., USA; Journal of Aircraft; Apr. 1998; ISSN 0021-8669; Volume 35, no. 2, pp. 318-323; In English; Copyright; Avail: Aeroplus Dispatch

The application of adhesively bonded composite patches as reinforcements and crack arrestors for a multisite damaged aircraft structure is investigated. Experiments are performed to test the ability of a bonded composite reinforcement to prevent cracks from coalescing. With a finite element model developed for composite patch repairs, the effect of thermal residual stresses on the stress-intensity factor and the resulting fatigue crack growth rate is demonstrated. An effective thermal stress is estimated by comparing experimental results with model predictions. Reinforcement for a multiple-site damage situation is analyzed by modeling an infinite row of closely spaced cracked rivet holes. The composite reinforcement is shown to dramatically reduce the stress-intensity factor, increase fatigue life, and protect against catastrophic failure.

Author (AIAA)

Aircraft Structures; Adhesive Bonding; Reinforcement; Crack Closure; Fatigue Life; Composite Materials

19980048115
Effect of low-solidity vaned diffusers on the performance of a turbocharger compressor

Eynon, P. A., Univ. of Bath; Whitfield, A.; Proceedings of the Institution of Mechanical Engineers, Part C: Journal of Mechanical Engineering Science; 1997; ISSN 0954-4062; Volume 211, no. 5, pp. 325-339; In English; Copyright; Avail: Issuing Activity

The design of low-solidity diffuser vanes and the effect on the performance of a turbocharger compressor is discussed. The effect of vane number and turning angle was investigated while maintaining a basic design with a solidity of 0.69 and a leading edge angle of 75 deg. This large leading edge angle was specifically chosen so that the vane would be aligned with the low flowrates close to surge. Tests were initially conducted with six, eight and ten vanes and a turning angle of 10 deg. Based on these results the ten-vane design was selected for further investigation with 15 and 20 deg of vane turning; this led to vane exit angles of 60 and 55 deg respectively. All results are compared with those obtained with the standard vaneless diffuser configuration and it was shown that all designs increased and shifted the peak pressure ratio to reduced flowrates. The peak efficiency was reduced relative to that obtained with the vaneless diffuser. Despite the low-solidity configuration none of the vane designs provided a broad operating range without the use of a variable geometry configuration. This was attributed to the selection of a large leading edge vane angle.

EI

Compressors; Turbomachinery; Mechanical Engineering

19980048182

A profile pulsing under the free surface of a ponderable fluid over a horizontal bottom *Kontur, pul'siruyushchij pod svobod-noj poverkhnost'yu vesomoj zhidkosti nad gorizontal'nym dnom*

Filippov, S. I., Kazanskij Gosudarstvennyj Univ., Russia; Aviatsionnaya Tekhnika; 1997; ISSN 0579-2975, no. 3, pp. 36-39; In Russian; Copyright; Avail: Aeroplus Dispatch

The problem of pulsations of a circular cylinder in a ponderable fluid is investigated analytically. The method used here is based on the distribution of singularities with respect to the unperturbed level of the free surface and the bottom line. The problem for a circular cylinder represents a model problem for an airfoil of arbitrary shape. by using conformal mapping, the problem can be extended to any wing airfoil.

AIAA

Oscillating Flow; Horizontal Orientation; Free Flow; Circular Cylinders; Conformal Mapping; Wing Oscillations

19980048292

Efficient complex modal testing theory for asymmetric rotor systems: Use of unidirectional excitation method

Lee, Chong-Won, Korea Advanced Inst. of Science and Technology, Republic of Korea; Lee, Seok-Ku; Journal of Sound and Vibration; September 25, 1997; ISSN 0022-460X; Volume 206, no. 3, pp. 327-338; In English; Copyright; Avail: Issuing Activity

A complex modal testing theory is newly developed for asymmetric rotor systems. The theoretical development is made strictly in the stationary co-ordinate system, and this enables a unidirectional excitation technique efficiently to estimate the directional frequency response functions, which greatly lessens the testing efforts and enhances the practicality of the theory.

Author (EI)

Rotors; Applications of Mathematics

19980048610

Turbulent structure of an intermittent region of the turbulent boundary layer interacting with controlled longitudinal vortex arrays

Fukushima, Chiharu, Gifu Univ., Japan; Osaka, Hideo, Yamaguchi Univ., Japan; Nedelcu, Gabriela, Yamaguchi Univ., Japan; 1997, pp. P2-55 to P2-60; In English; Copyright; Avail: Aeroplus Dispatch

Conditional averaged patterns on the outer layer of a turbulent boundary layer are investigated to elucidate the developing process of the boundary layer interacting with the spanwise periodic longitudinal vortex arrays artificially generated in a free-stream. Two parameters, namely, spanwise periodicity of the longitudinal vortex arrays, L/S, and the arrangement height of the airfoil arrays, were independently varied for five cases. Intermittency factor profiles demonstrated the effect of pairs of counterrotating secondary flows, which showed the downwash flow at the midspan of the airfoil, and conversely, the upwash flow for the center slice of the neighboring airfoils. Intermittency factors are remarkably affected by the spacing between neighboring airfoils. The value of the intermittency factor becomes smaller in the inner layer with increasing values of L/S at the midspan of the airfoil.

Author (AIAA)

Turbulent Boundary Layer; Vortices; Airfoil Profiles; Two Dimensional Flow; Flow Characteristics

19980048633

Unbalance response and stability analysis of horizontal rotor systems mounted on nonlinear rolling element bearings with viscoelastic supports

Bhattacharyya, K., Dep. of Mechanical Engineering, India; Dutt, J. K.; Journal of Vibration and Acoustics, Transactions of the

Unbalance response and stability analysis of a rotor shaft system, with the rotor mounted in the middle of a massless shaft, having linear elasticity and internal damping, with bearings having nonlinear restoring force characteristics at the ends mounted on viscoelastic support, has been carried out, taking the effect of gravity into account. The restoring force characteristics of the bearing has been linearized, by the method of effective linearization, thereby enabling an approximate stability analysis using simple techniques. It is found that, unlike the case with a bearing having linearly varying restoring force characteristics, gravity not only affects the unbalance response but also causes a decrease in the stability limits when the restoring force characteristics are nonlinear.

Author (EI)

Stability Tests; Rotors; Stability; Frequency Response; Bearings; Rollers

19980048682

Ultrasonic inspection technique for composite doubler/aluminum skin bond integrity for aircraft

Gieske, John H., Sandia National Labs., USA; Roach, Dennis P., Sandia National Labs., USA; Walkington, Phillip D., Sandia National Labs., USA; 1998, pp. 148-155; In English; Copyright; Avail: Aeroplus Dispatch

As part of the FAA's National Aging Aircraft Research Program to foster new technologies for civil aircraft maintenance and repair, the use of bonded composite doublers on metal aircraft structures has been advanced. A primary inspection requirement for these doublers is the identification of disbonds between the composite laminate and the aluminum parent material. This paper describes the development of an ultrasonic pulse-echo technique using a modified immersion focus transducer where a robust signal amplitude signature of the composite/aluminum interface is obtained to characterize the condition of the bond. Example waveforms and C-scan images are shown to illustrate the ultrasonic response for various transducer configurations using a boron-epoxy/aluminum skin calibration test sample where disbonds and delaminations were built in. The modified focus transducer is compatible with portable ultrasonic scanning systems that utilize the weeper or dripless bubbler technologies when an ultrasonic inspection of the boron-epoxy composite doublers installed on aircraft is implemented.

Author (AIAA)

Ultrasonic Flaw Detection; Composite Structures; Aircraft Structures; Skin (Structural Member); Boron-Epoxy Composites

19980048688

Finite element analysis of a magnetic sensor to detect permeability changes due to residual stresses in ferromagnetic materials

Govindaraju, M., Karta Technology, Inc., USA; Katragadda, G., Karta Technology, Inc., USA; Wallace, J. L., Karta Technology, Inc., USA; 1998, pp. 47-55; In English
Contract(s)/Grant(s): N00140-97-C-G217; Copyright; Avail: Aeroplus Dispatch

High strength steel alloys (such as 300M) used in naval aircraft engine and landing gear components are subjected to cyclic loading in service and found to be highly susceptible to fatigue cracking. There is a critical need for NDE techniques that can detect both cracking and potential crack nucleation sites within these components. An innovative EM technology, called the Stress induced-Magnetic-Anisotropy (SMA) technique, has been proposed for detecting and evaluating residual stresses. SMA measures residual stresses by sensing the changes in magnetic flux induced in directions parallel and perpendicular to the stress. A novel probe and instrumentation is being developed to simultaneously detect both subsurface residual stresses and stress-induced cracking in coated and uncoated ferromagnetic structures. Finite element analysis is used to determine the distribution of magnetic flux density and inductance of the probe under varying ac fields. Using ANSYS EMAG, the effects of varying frequency of the excitation field, permeability, and dimensions of the core are analyzed. The paper describes how finite element analysis can be used in design and development of the probe and in understanding its behavior.

Author (AIAA)

Finite Element Method; Permeability; Residual Stress; Ferromagnetic Materials; High Strength Steels; Landing Gear

19980048713

Airborne measurement of aircraft emissions using passive infrared FT spectroscopy

Haschberger, Peter, DLR, Inst. fuer Optoelektronik, Germany; Lindermeir, Erwin, DLR, Inst. fuer Optoelektronik, Germany; Tank, Volker, DLR, Inst. fuer Optoelektronik, Germany; Pollutants from air traffic - Results of atmospheric research 1992-1997; 1997, pp. 89-98; In English; Copyright; Avail: Aeroplus Dispatch

For the first time emissions from aircraft jet engines where measured inflight with the aid of a Fourier transform IR spectrometer. The instrument works in a nonintrusive mode, observing the plume from the cabin and detecting the emitted IR radiation. Nonlinear inversion techniques are used to calculate the concentrations and emission indices of the IR active gas components. Besides

CO, CO2, and water vapor, the separate acquisition of NO and NO2 is of special interest. For the ATTAS research aircraft as a first carrier, the emission index of NO(x), EI(NO(x)) is in the range of 5-7.5 g(NO2)/(kg fuel) with a NO2/NO(x) ratio of 12-22 percent. The precision of the measurement system is better than 5 percent, and the estimated accuracy depends on the species and ranges between 5-25 percent. This report presents a summary of the results, including a comparison of measured data and ground-to-altitude correlation models.

Author (AIAA)

Jet Engines; Aircraft Engines; Exhaust Gases; In-Flight Monitoring

19980048742

Lockheed Martin adopting 'virtual' product system

Phillips, Edward H., USA; Aviation Week & Space Technology; Feb. 16, 1998; ISSN 0005-2175; Volume 14, no. 7, pp. 69; In English; Copyright; Avail: Aeroplus Dispatch

Advanced product visualization tools are being implemented at Lockheed Martin's Aeronautics Sector with a view to significantly reducing cycle time and costs and transforming it into a 'virtual company'. The integration of visualization products and digital prototyping software is part of a program aimed at restructuring Lockheed Martin's aircraft development process into a large-scale interactive visual environment. The system will be used to reduce product cycle time and costs across the product line, including F-22, F-16, and the X-33 launch vehicle.

AIAA

Product Development; Aircraft Production; Systems Integration; Software Engineering; Virtual Reality; Lockheed Aircraft

19980048771

A stand alone remotely interrogated device for the real time health monitoring of bonded structural repairs

Galea, Stephen C., DSTO, Aeronautical and Maritime Research Lab., Australia; Powlesland, Ian G., DSTO, Aeronautical and Maritime Research Lab., Australia; Baker, Alan A., DSTO, Aeronautical and Maritime Research Lab., Australia; 1997, pp. 66-75; In English; Copyright; Avail: Aeroplus Dispatch

Adhesively-bonded fiber-reinforced composite patches have been used extensively, over the last two decades, on Royal Australian Air Force (RAAF) aircraft to repair fatigue-cracked metallic aircraft components. The bonded repair to the cracked structure, 'crack patching', allows the restoration of strength and stiffness to the structure, as well as slowing crack growth by reducing stress intensity. However, especially for repairs to critical components, the bonded repair needs continuous health monitoring to ensure structural integrity is not compromised. The ultimate goal for very demanding repairs is to incorporate sensors, actuators and electronics in repair systems ('smart repair systems') to monitor and report on the health of the repaired structure, as well as to actuate, in order to prevent damage or failure of the repaired structure. The initial focus in the development of smart repair systems is on assessment of new sensors and instrumentation which may be incorporated in bonded repair systems in order to achieve on-line measurement of patch integrity and effectiveness. This application would allow the operator to move away from current costly time-based maintenance procedures toward real-time health condition monitoring of the bonded repair and the repaired structure.

Author (AIAA)

Fiber Composites; Adhesive Bonding; Crack Closure; Aircraft Maintenance

19980048855

Stability of a towed body

Etkin, Bernard, Toronto, Univ., Canada; Journal of Aircraft; Apr. 1998; ISSN 0021-8669; Volume 35, no. 2, pp. 197-205; In English; Copyright; Avail: Aeroplus Dispatch

This paper presents a mathematical model for the efficient computation of the stability of bodies subject to fluid-dynamic forces while constrained by a flexible, extensible cable. The way the cable is represented permits the body to be heavier or lighter than air and to have a steady-state lift. The model is applied to the case of a pendant vehicle towed by a cable attached to an aircraft, a case of considerable practical interest. It is shown that inherent instabilities are present and that they can be eliminated by the correct method of cable attachment. The paper emphasizes the physics of the system and the reasons for the instabilities.

Author (AIAA)

Towed Bodies; Fluid Dynamics; Mathematical Models; Lift; Aerodynamic Forces

Includes geosciences (general); earth resources and remote sensing; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.

19980041671

Experimental studies on a Savonius rotor with casing

Tan, S.; Shimizu, Y.; Kikuyama, K.; Nippon Kikai Gakkai Ronbunshu, B Hen/Transactions of the Japan Society of Mechanical Engineers, Part B; July, 1997; ISSN 0387-5016; Volume 63, no. 611, pp. 2356-2363; In Mixed; Copyright; Avail: Issuing Activity

The Savonius turbine, which works at low rotatory speeds and gives a high degree of torque, has been used for a wind turbines. In order to examine the feasibility of applying the turbine as a wave energy conversion system, a Savonius rotor was installed in a casing and its performance was studied experimentally to examine the various geometrical configurations of the rotor and casing. When optimally cnfigured, the turbine exhibits higher efficiency than a wind turbine without a casing during steady flow conditions.

Author (EI)

Compressed Air; Turbomachinery; Rotors; Waterwave Energy Conversion

19980041781

Effect of aircraft engine exhaust gases on the environment

Sen, Orhan, Istanbul Technical Univ., Turkey; International Journal of Environment and Pollution; 1997; ISSN 0957-4352; Volume 8, no. 1-2, pp. 148-157; In English; Copyright; Avail: Issuing Activity

The sources of air pollution are classified as point, line and surface sources. Motor vehicle pollution is modelled as a line source. Hitherto, studies of air pollution have emphasized surface pollution caused by fossil fuel burning for the purposes of obtaining energy and heating, and motor vehicle pollution studies are usually concentrated on land vehicles. In this study, the effect of aircraft emissions on the environment is considered from two different aspects: during cruising, and during landing, take-off and the taxiing. Air pollution caused by aircraft is also estimated for the year 2000, and the pollution caused during cruising is given globally. The contribution of the Istanbul Ataturk airport to surface air pollution is estimated. In addition, the pollution caused by motor vehicles and aircraft are compared, and the variation and the spread of the pollution under certain meteorological conditions are studied.

Author (EI)

Air Pollution; Aircraft Engines; Exhaust Gases; Environmental Surveys; Air Transportation

19980042667

Comparison of aerodynamic roughness (Z-0) values from wind measurements and SRL radar - Western U.S. and Namibian deserts

McHone, J. F., Arizona State Univ., Tempe, USA; Greeley, R., Arizona State Univ., Tempe; Blumberg, D. G., Negev, Univ., Israel; 1997, pp. 917, 918; In English; Copyright; Avail: AIAA Dispatch

Aerodynamic roughness (z-0), the height above a surface at which a wind profile assumes zero velocity and an important parameter in studies of atmospheric circulation and aeolian sediment transport, is strongly influenced by size and spacing of surface roughness elements. Its value, in meters, is derived from field measurements of wind velocity profiles. Because of complexities in field logistics, z-0 measurements exist for relatively few localities. If z-0 can be estimated with radar, large areas can be mapped quickly and repeatedly. Z-0 and the radar backscatter coefficient s-0 (in dB) are both functions of submeter topography and correlations of z-0 with s-0 have been developed from aircraft radar data. The Spaceborne Radar Laboratory (SRL) has allowed testing of similar correlations for orbital radar data. SRL is a multiwavelength, multipolarization imaging radar system flown on the Shuttle Endeavour in April (SRL-1) and October (SRL-2), 1994. SRL obtained digital radar data in L-band and C-band. The L- and C-band systems transmited and received in horizontally or vertically polarized modes, to provide a scattering matrix of HH, VV, VH, and HV combinations.

Author (AIAA)

Wind Measurement; Space Based Radar; Deserts; Wind Profiles; Aerodynamic Characteristics

19980047346 Boeing Co., Long Beach, CA USA

Military, Charter, Unreported Domestic Traffic and General Aviation 1976, 1984, 1992, and 2015 Emission Scenarios

Mortlock, Alan, Boeing Co., USA; VanAlstyne, Richard, Boeing Co., USA; Mar. 1998; 120p; In English

Contract(s)/Grant(s): NAS1-20268; RTOP 538-08-16

The report describes development of databases estimating aircraft engine exhaust emissions for the years 1976 and 1984 from global operations of Military, Charter, historic Soviet and Chinese, Unreported Domestic traffic, and General Aviation (GA). These databases were developed under the National Aeronautics and Space Administration's (NASA) Advanced Subsonic Assessment (AST). McDonnell Douglas Corporation's (MDC), now part of the Boeing Company has previously estimated engine exhaust emissions' databases for the baseline year of 1992 and a 2015 forecast year scenario. Since their original creation, (Ward, 1994 and Metwally, 1995) revised technology algorithms have been developed. Additionally, GA databases have been created and all past NIDC emission inventories have been updated to reflect the new technology algorithms. Revised data (Baughcum, 1996 and Baughcum, 1997) for the scheduled inventories have been used in this report to provide a comparison of the total aviation emission forecasts from various components. Global results of two historic years (1976 and 1984), a baseline year (1992) and a forecast year (2015) are presented. Since engine emissions are directly related to fuel usage, an overview of individual aviation annual global fuel use for each inventory component is also given in this report.
Author

Exhaust Emission; Exhaust Gases; Combustion Products; General Aviation Aircraft; Military Aircraft; Aircraft Fuels

19980047471

Simulating the global climate impact of aircraft emissions

Sausen, Robert, DLR, Inst. fuer Physik der Atmosphaere, Germany; Ponater, Michael, DLR, Inst. fuer Physik der Atmosphaere, Germany; Brinkop, Sabine, DLR, Inst. fuer Physik der Atmosphaere, Germany; Dameris, Martin, DLR, Inst. fuer Physik der Atmosphaere, Germany; Feneberg, Brigitte, DLR, Inst. fuer Physik der Atmosphaere, Germany; Grewe, Volker, DLR, Inst. fuer Physik der Atmosphaere, Germany; Hein, Ralf, DLR, Inst. fuer Physik der Atmosphaere, Germany; Koehler, Ines, DLR, Inst. fuer Physik der Atmosphaere, Germany; Land, Christine, DLR, Inst. fuer Physik der Atmosphaere, Germany; Schumann, Ulrich, DLR, Inst. fuer Physik der Atmosphaere, Germany; Pollutants from air traffic - Results of atmospheric research 1992-1997; 1997, pp. 243-253; In English; Copyright; Avail: Aeroplus Dispatch

Several aspects of aircraft impact on the climate are investigated by means of GCM simulations. The direct climatic effect of aircraft water vapor emissions is negligible. Contrails have the potential for significant climate modifications. NO(x) emissions by aircraft cause an essential enhancement of the background NO(x) concentration and an increase of the O3 concentration. Aircraft-induced ozone changes result in a statistically significant tropospheric warming.
Author (AIAA)

Computerized Simulation; Climatology; Exhaust Gases; Aircraft Engines; Greenhouse Effect; Oxygen

19980047472

On the increase of NO(x) and NMHC mixing ratios in the upper troposphere due to aircraft emissions

Rohrer, Franz, Forschungszentrum Juelich GmbH, Inst. fuer Atmosphaerische Chemie, Germany; Bruening, Dirk, Forschungszentrum Juelich GmbH, Inst. fuer Atmosphaerische Chemie, Germany; Grobler, Ellen S., Forschungszentrum Juelich GmbH, Inst. fuer Atmosphaerische Chemie, Germany; Johnen, Franz-Josef, Forschungszentrum Juelich GmbH, Inst. fuer Atmosphaerische Chemie, Germany; Khedim, Ahmed, Forschungszentrum Juelich GmbH, Inst. fuer Atmosphaerische Chemie, Germany; Koch, Helmut, Forschungszentrum Juelich GmbH, Inst. fuer Atmosphaerische Chemie, Germany; Koppmann, Ralf, Forschungszentrum Juelich GmbH, Inst. fuer Atmosphaerische Chemie, Germany; Mueller, Klaus-Peter, Forschungszentrum Juelich GmbH, Inst. fuer Atmosphaerische Chemie, Germany; Rudolph, Jochen, Forschungszentrum Juelich GmbH, Inst. fuer Atmosphaerische Chemie, Germany; Schrimpf, Wolfram, Forschungszentrum Juelich GmbH, Inst. fuer Atmosphaerische Chemie, Germany; Pollutants from air traffic - Results of atmospheric research 1992-1997; 1997, pp. 271-279; In English; Copyright; Avail: Aeroplus Dispatch

As estimated by model calculations, emissions by subsonic aircraft contribute about 30 percent to the burden of nitrogen oxides in the upper troposphere at northern midlatitudes. The enhanced nitrogen oxide concentrations influence the photochemical production of ozone as well as the steady state concentrations of hydroxyl radicals, OH, in the upper troposphere. Current estimates place the resulting zonally averaged increase of summertime ozone around 5 percent. That increase is small compared to the impact of NO(x) from fossil fuel combustion on boundary layer ozone. Both, the increase of nitrogen oxides due to aircraft emissions and the resulting ozone increase cannot be measured directly with justifiable expense. We therefore depend on model calculations. It is shown that the magnitude of local ozone production strongly depends on the background concentration of nitrogen oxides. For this reason we measured the actual concentrations of nitrogen oxides and other relevant trace species in the upper

troposphere near the North Atlantic flight corridor at Prestwick and Brest as well as at more remote locations near Faro and Tenerife. The measurements are compared to model calculations of the nitrogen oxide budget.
Author (AIAA)
Nitrogen Oxides; Troposphere; Exhaust Gases; Aircraft Engines; Subsonic Aircraft; Ozone

19980047480

Overview on Workpackage 100 - Magnitude and distribution of emissions from aviation
Schmitt, Alf, DLR, Hauptabt. Verkehrsforschung, Germany; Pollutants from air traffic - Results of atmospheric research 1992-1997; 1997, pp. 23-26; In English; Copyright; Avail: Aeroplus Dispatch
The first step in assessing pollution from air traffic is to characterize and quantify the subject under consideration, emissions from aircraft. Within the BMBF-Project Pollutions from Air Traffic, Workpackage 100 (in Phase 1, Workpackage 1100) has undertaken the task of compiling, as far as is possible, and of processing relevant emissions data, especially those needed for other workpackages of the BMBF Project.
Author (AIAA)
Air Traffic; Air Pollution; Exhaust Gases; Aircraft Engines

19980047481

Mass spectrometric measurements of trace gases, ions, and condensed sulfuric acid in jet aircraft exhaust
Arnold, F., Max-Planck-Inst. fuer Kernphysik, Germany; Klemm, M., Max-Planck-Inst. fuer Kernphysik, Germany; Wohlfrom, K.-H., Max-Planck-Inst. fuer Kernphysik, Germany; Stilp, Th., Max-Planck-Inst. fuer Kernphysik, Germany; Reiner, Th., Max-Planck-Inst. fuer Kernphysik, Germany; Schneider, J., Max-Planck-Inst. fuer Kernphysik, Germany; Curtius, J., Max-Planck-Inst. fuer Kernphysik, Germany; Grimm, F., Max-Planck-Inst. fuer Kernphysik, Germany; Sierau, B., Max-Planck-Inst. fuer Kernphysik, Germany; Frenzel, A., Max-Planck-Inst. fuer Kernphysik, Germany; Pollutants from air traffic - Results of atmospheric research 1992-1997; 1997, pp. 67-78; In English; Copyright; Avail: Aeroplus Dispatch
We performed both ground-based and aircraft-based measurements of trace gases, ions, and condensed sufuric acid in the wake of jet engines using quadrupole mass spectrometry in order to assess the impact of aircraft emissions on the atmosphere. We report on the most striking results which we obtained since 1992 within the Pollutions from Air Traffic project. At a plume age of 10 ms the precursor core ion NO3 was only observed while the engines burnt fuel with a low sulfur content. The composition of ions measured under atmospheric conditions at 11 km altitude behind an Airbus A 310 at a distance of about 600 m did not differ significantly from the composition of ions in the ambient atmosphere within a mass range of 1100 amu. The mean total effective aerosol surface area density was estimated.
Author (AIAA)
Mass Spectroscopy; Ions; Sulfuric Acid; Exhaust Gases; Jet Aircraft

19980047482

Effective diffusion of aircraft emissions at micro- and mesoscales
Gerz, Thomas, DLR, Inst. fuer Physik der Atmosphaere, Germany; Duerbeck, Tilman, DLR, Inst. fuer Physik der Atmosphaere, Germany; Konopka, Paul, DLR, Inst. fuer Physik der Atmosphaere, Germany; Pollutants from air traffic - Results of atmospheric research 1992-1997; 1997, pp. 103-112; In English; Copyright; Avail: Aeroplus Dispatch
The transport, mixing, and effective diffusion of aircraft exhaust from the airplane to the range of atmospheric mesoscale flow, i.e., from seconds and meters to hours and tens of kilometers, are determined. by means of a chain of large eddy simulations, the dynamics in the wake embedded in a stably stratified, sheared, and turbulent atmosphere is calculated, including the dilution of a chemically inert species (e.g. CO2) concentration. The numerical data are compared to in situ measured data. From the concentration fields various dilution and diffusion measures are obtained. It is found that the evolving wingtip vortices produced by the lift of the aircraft distort and attract the exhaust jets immediately. The largest fraction of the exhaust is trapped close to the vortex cores (primary wake) after 20 s, where it is not further mixed and diluted with ambient air until the vortices collapse. However, the baroclinic torque at the border between vortex and surrounding air detrains about 10 to 30 percent of the exhaust mass (depending on atmospheric turbulence and stratification) from the vortices into the so-called secondary wake where it mixes rapidly.
Author (AIAA)
Mesoscale Phenomena; Aircraft Engines; Exhaust Gases

19980047484

Overview on Workpackage 320 - Modelling of contrails

Chlond, Andreas, Max-Planck-Inst. fuer Meteorologie, Germany; Pollutants from air traffic - Results of atmospheric research 1992-1997; 1997, pp. 193-195; In English; Copyright; Avail: Aeroplus Dispatch

The role of various external parameter and physical processes in the life cycle of contrails is studied with a large eddy simulation model that includes most of the physical processes occurring in ice clouds in the absence of solar radiation. It is found that persistent contrails can form only in an atmosphere that is supersaturated with respect to ice. Coherent structures forming within these clouds exhibit vertical velocity fluctuations of the order of 0.1 m/s and are mainly generated by buoyancy. Sensitivity runs undertaken as a test of the model to a change in significant physical processes or external parameters indicate that contrail evolution is controlled primarily by humidity, temperature, and static stability of the ambient air and secondarily by shear winds in the atmosphere.

AIAA

Contrails; Aircraft Engines; Exhaust Gases

19980047709

Aircraft released NO(x) and the tropospheric ozone budget - Sensitivity studies with a 3D global CTM

Zimmermann, Peter H., MOGUNTIA Global Modelling, Germany; Pollutants from air traffic - Results of atmospheric research 1992-1997; 1997, pp. 263-270; In English; Copyright; Avail: Aeroplus Dispatch

The 3D photochemistry/transport model (CTM) MOGUNTIA was applied to estimate the disturbances in the tropospheric background NO(x) and ozone mixing ratios caused by NO(x) emissions from air traffic. A global data set of the NO(x) emissions from subsonic aircraft was implemented into the model. Global distributions of the proportionate NO(x) and ozone contributions that can be ascribed to aircraft emissions are presented for July average meteorological conditions. As a result of the source segregated transport of NO(x) and its photochemical products, the calculated aircraft ozone production is quantified correctly with respect to the nonlinearity of the chemical equation system.

Author (AIAA)

Nitrogen Oxides; Troposphere; Sensitivity; Ozone; Exhaust Gases; Subsonic Aircraft

19980047710

Climate impact of aircraft emissions in the upper troposphere - Studies with a 2D-model

Schmitz, G., IAP - Inst. fuer Atmosphaerenphysik, Germany; Gabriel, A., IAP - Inst. fuer Atmosphaerenphysik, Germany; Gepraegs, R., IAP - Inst. fuer Atmosphaerenphysik, Germany; Pollutants from air traffic - Results of atmospheric research 1992-1997; 1997, pp. 255-261; In English; Copyright; Avail: Aeroplus Dispatch

A new, efficient, interactive dynamical-chemical radiative 2D model based on the standard climate 3D-GCM ECHAM3 and a coupled NCAR chemistry module was developed to study the climate impact of aircraft emissions. The main feature of the 2D model is self-consistent parameterization of the tropospheric eddy heat and momentum fluxes. Assuming perpetual January conditions, the results give a realistic picture of the zonally averaged meridional mass circulation, the tracer transport, and the chemistry. In this case, the NO(x) background concentrations depend on the composition of downward sinking lower stratospheric air masses and on the tropopause structure in northern winter midlatitudes. The inclusion of zonally averaged January civil aircraft NO(x) emissions leads to a positive maximum disturbance in the NO(x) mixing ratio of about 60 ppt (50 percent) in the area of the maximum of the aircraft emissions and induces a positive change in the upper tropospheric O3 mixing ratio of about 1-1.5 ppb (1 percent). The advantage of the 2D model is its greater efficiency in carrying out further dynamical-chemical coupled sensitivity studies to elucidate the dynamical-chemical interactions and the climatic features of both the background and the disturbed atmosphere.

Author (AIAA)

Climatology; Exhaust Emission; Aircraft Engines; Troposphere; Two Dimensional Models; Subsonic Aircraft

19980047711

Simulation of transport and chemical transformation of aircraft exhaust at the tropopause region - Three-dimensional episodic mesoscale studies

Petry, Heribert, Cologne, Univ., Germany; Lippert, Elmar, Cologne, Univ., Germany; Hendricks, Johannes, Cologne, Univ., Germany; Ebel, Adolf, Cologne, Univ., Germany; Pollutants from air traffic - Results of atmospheric research 1992-1997; 1997, pp. 229-242; In English; Copyright; Avail: Aeroplus Dispatch

A mesoscale chemistry transport model was developed and applied to investigate the impact of aircraft emissions on the atmospheric trace gas composition in the tropopause region. Several real episodes representing different seasons were simulated. The

model results were compared with measurements, and showed reasonable agreement. The emission-induced ozone production is a function of the synoptic situation, the season, the time and location of release, the cruise altitude and its distance to the tropopause, and the aerosol loading of the environment. The simulations also show that a considerable part of the emitted NO(x) is rapidly converted into the reservoir species HNO3. A further finding is that heterogeneous reactions taking place on/in sulfuric acid aerosols cause a strong enhancement of the aircraft-induced ozone and HNO3 production.
Author (AIAA)

Computerized Simulation; Transport Properties; Chemical Reactions; Exhaust Gases; Aircraft Engines; Mesoscale Phenomena

19980047712

Overview on Workpackage 400 - Impact upon ozone and climate: Regional and global modelling

Ebel, Adolf, Cologne, Univ., Germany; Pollutants from air traffic - Results of atmospheric research 1992-1997; 1997, pp. 225-227; In English; Copyright; Avail: Aeroplus Dispatch

Consideration is given to three types of models employed within the context of the Pollutants from Air Traffic program for regional and global modeling: The EURAD model system, versions 3 and 4 of the ECHAM 3D general circulation model, and a novel 2D interactive-chemical radiative model. Efficiency of air traffic NO(x) emissions is also examined.
AIAA

Ozone; Climatology; Air Traffic; Exhaust Gases; Aircraft Engines; Contaminants

19980048706

Aircraft measurements on the formation and dilution of contrails

Busen, Reinhold, DLR, Inst. fuer Physik der Atmosphaere, Germany; Baumann, Robert, DLR, Inst. fuer Physik der Atmosphaere, Germany; Petzold, Andreas, DLR, Inst. fuer Physik der Atmosphaere, Germany; Schroeder, Franz, DLR, Inst. fuer Physik der Atmosphaere, Germany; Schumann, Ulrich, DLR, Inst. fuer Physik der Atmosphaere, Germany; Pollutants from air traffic - Results of atmospheric research 1992-1997; 1997, pp. 171-181; In English; Copyright; Avail: Aeroplus Dispatch

Different aspects connected with aircraft plumes, vortices, and condensation trails are investigated experimentally. Results cover the geometrical, physical, and dynamical characterization, as well as insights on chemical composition, chemical reactions, and the influence of sulfur contained in kerosene. The experimental data on cross section and descent speed of contrails agree well with theoretical models of contrail dynamics. The turbulence level inside contrails is up to two orders of magnitude higher than in the surrounding atmosphere, but in old contrails turbulence is not important for dissipating the exhaust gases. A differential water vapor absorption lidar was modified for detecting even small-scale water vapor distributions connected with cirrus clouds and contrails. Measurements behind aircraft burning fuels with different fuel sulfur content during the same flight have shown that the onset of contrail formation depends very little on the fuel sulfur content. High fuel sulfur content causes larger numbers of condensation nuclei in young contrails and slightly larger numbers of ice particles.
Author (AIAA)

Contrails; Aircraft Engines; Exhaust Gases; Chemical Composition; Chemical Reactions; Sulfur

19980048708

Overview on Workpackage 310 - Measurement of contrail properties

Wendling, Peter, DLR, Inst. fuer Physik der Atmosphaere, Germany; Pollutants from air traffic - Results of atmospheric research 1992-1997; 1997, pp. 145-147; In English; Copyright; Avail: Aeroplus Dispatch

Since the global air traffic is steadily increasing, there is growing concern that the emissions of the air traffic, in particular water vapor, carbon dioxide, nitrogen oxides, and particles, might affect the structure and the climate of the atmosphere. In addition, under favorable conditions contrails form in the exhaust of aircraft and may enhance the natural cirrus cloud cover. Due to their position in the upper troposphere and their predominantly thin optical thickness, cirrus clouds tend to heat the atmosphere. It was therefore the aim of Workpackage 310 (later 1310) to carry out in situ and remote observations on contrails in order to study the relevant processes for their formation, spreading, and dissipation, and to determine the optical properties of contrails during their life cycle. A further aim was the determination of the additional cirrus cloud cover caused by the air traffic over Europe and the eastern part of the North Atlantic region and the determination of their effects on the radiation budget of the atmosphere.
Author (AIAA)

Contrails; Air Traffic; Exhaust Gases; Troposphere; Aircraft Engines

Simulation of transport and chemical transformation of aircraft exhaust at the tropopause region - Box model studies

Petry, Heribert, Koeln, Univ., Germany; Lippert, Elmar, Koeln, Univ., Germany; Hendricks, Johannes, Koeln, Univ., Germany; Ebel, Adolf, Koeln, Univ., Germany; Pollutants from air traffic - Results of atmospheric research 1992-1997; 1997, pp. 123-134; In English; Copyright; Avail: Aeroplus Dispatch

Within the framework of the STRATFLUT project (Simulation of the Transport and the Chemical Transformation of Aircraft Exhaust at the Tropopause Region) a chemistry mechanism for applications in the tropopause region was developed and continuously improved (CHEST/CHEST2). This mechanism has been applied in various sensitivity studies and to the evaluation of effective aircraft emission indices. In particular, an increase of ozone production due to air-traffic induced NO(x) emissions is found. This increase depends in a nonlinear manner on the atmospheric background conditions into which the exhaust is released, on the altitude of release (absolute and relative to the tropopause), on the emission amount, on the daytime of release, on season, and on aerosol loading. The effect of NO(x) released during one day by a fleet of 10 aircraft into a box on ozone was found to vary between 0.05 and 2.3 ppbv (relative changes between approximately 0.02 and 6.57 percent) depending on the specific assumptions for the respective experiment.

Author (AIAA)

Computerized Simulation; Aircraft Engines; Exhaust Gases; Tropopause; Chemical Reactions; Ozone

Overview on Workpackage 220 - Modeling of aircraft emissions and their transformation on the wake and regional scales

Kaercher, Bernd, DLR, Inst. fuer Physik der Atmosphaere, Germany; Pollutants from air traffic - Results of atmospheric research 1992-1997; 1997, pp. 99-102; In English; Copyright; Avail: Aeroplus Dispatch

The five theoretical projects that constitute Workpackage 220 cover various aspects of near-field processing, i.e., the chemical and microphysical fate of pollutants released from jet engines in the dispersing wake behind cruising airliners. Project 221 investigated the effective diffusion of aircraft emissions at the micro- and mesoscales. Project 222 focused on chemical and microphysical processes in young aircraft plumes. Project 223 studied transport and chemical transformation processes on regional scales at the tropopause. Project 224 developed a new regional-scale chemical mechanism for the evaluation of subsonic aircraft effects on the upper troposphere. Project 225 studied liquid phase chemistry and ice formation in the jet regime with a modified cloud chemical model.

Author (AIAA)

Aircraft Engines; Aircraft Wakes; Jet Engines; Air Pollution; Exhaust Gases; Atmospheric Chemistry

In-situ measurement in aircraft exhaust plumes and in North Atlantic air traffic corridor

Slemr, Franz, Fraunhofer-Inst. fuer Atmosphaerische Umweltforschung, Garmisch-Partenkirchen, Germany; Giehl, Helmut, Fraunhofer-Inst. fuer Atmosphaerische Umweltforschung, Garmisch-Partenkirchen, Germany; Slemr, Jana, Fraunhofer-Inst. fuer Atmosphaerische Umweltforschung, Garmisch-Partenkirchen, Germany; Pollutants from air traffic - Results of atmospheric research 1992-1997; 1997, pp. 79-87; In English; Copyright; Avail: Aeroplus Dispatch

Concentrations of nonmethane hydrocarbons (NMHCs) and CO were measured in exhaust plumes of ATTAS experimental aircraft of DLR equipped with Rolls Royce M 45H Mk501 engines. The emission indices (EIs) of individual light NMHCs were determined from ratios of NMHC and CO concentration enhancements measured in grab samples and the concurrent in-flight measurements of EIs of CO by FTIR emission spectroscopy. Alkenes and alkynes generated by cracking of larger NMHC molecules and aromatic compounds originating from unburnt fuel constituted a larger and a smaller fraction of the NMHC emissions, respectively. Measurements in the North Atlantic air traffic corridor were also made.

Author (AIAA)

Aircraft Engines; Exhaust Gases; Plumes; Atlantic Ocean; Air Traffic; Hydrocarbons

Overview on Workpackage 210 - Emission indices and distribution of aircraft related trace species in the upper troposphere and lower stratosphere

Schlager, Hans, DLR, Inst. fuer Physik der Atmosphaere, Germany; Pollutants from air traffic - Results of atmospheric research 1992-1997; 1997, pp. 53-56; In English; Copyright; Avail: Aeroplus Dispatch

The focus of Workpackage (WP) 210 was on the characterization of near-field emissions from individual source aircraft and their conversion to secondary exhaust products, the investigation of plume dispersal, and the analysis of regional effects of air-traffic emissions within the North Atlantic flight corridor. Thus, observations were necessary at scales ranging from the engine exit

plane and the aircraft wake to the heavily traveled airspace of a flight corridor. The WP210 includes the following projects: in situ measurements in aircraft exhaust plumes and in the North Atlantic flight corridor, and airborne measurements of aircraft emissions using passive IR Fourier transform spectroscopy. The following activities were carried out: development of fast-response aircraft-borne in situ and nonintrusive remote sensing measuring techniques for aircraft exhaust species; ground-based measurements behind jet engines; in-flight measurements of near-field aircraft emissions; and focused measurements of air-traffic related trace species in flight corridors.

Author (AIAA)

Aircraft Engines; Exhaust Emission; Troposphere; Stratosphere; Air Traffic

19980048717

Emissions from aviation and their development over time

Schmitt, Alf, DLR, Hauptabt. Verkehrsforschung, Germany; Brunner, Brigitte, DLR, Hauptabt. Verkehrsforschung, Germany; Pollutants from air traffic - Results of atmospheric research 1992-1997; 1997, pp. 37-52; In English; Copyright; Avail: Aeroplus Dispatch

In Workpackage 102 of the BMBF-Project Pollutants from Air Traffic, 3D inventories of emissions from aviation were calculated for historical years (1982-1992), current air traffic (baseyear 1991/1992), and future air traffic (2015). Together with international partners, a set of scenario inventories for 2050 has been drawn. Furthermore, a 4D emissions inventory with diurnal cycles of aircraft emissions during March 1992 has been produced. The basic elements for the calculation of the global distribution of aircraft emissions, data bases for global flight operations, the specific emissions of aircraft/engine combinations, and a computer program to assign the emissions to a global cell grid were developed by workpackage 102. The inventories were used as input for climate models in the BMBF program and other European research projects. The main results of this work are described in this report.

Author (AIAA)

Exhaust Emission; Air Traffic; Aircraft Engines; Civil Aviation; Military Aircraft

19980048719

The impact of aviation on the atmosphere - An overview on atmospheric research within the programme 'Pollutants from Air Traffic'

Schumann, Ulrich, DLR, Inst. fuer Physik der Atmosphaere, Germany; Pollutants from air traffic - Results of atmospheric research 1992-1997; 1997, pp. 1-21; In English; Copyright; Avail: Aeroplus Dispatch

'Pollutants from Air Traffc: Effects and Prevention' is a German research program that was performed over the years 1992-1997. The program is composed of an atmospheric science part and an engine technology part. It deals with the long-term effects of pollutants from air traffic on the atmosphere. This paper gives an overview on the program and summarizes the knowledge on the impact of aircraft emissions on the state of the atmosphere.

Author (AIAA)

Air Traffic; Air Pollution; Aircraft Engines; Exhaust Gases

14
LIFE SCIENCES

Includes life sciences (general); aerospace medicine; behavioral sciences; man/system technology and life support; and space biology.

19980041413 Armstrong Lab., Wright-Patterson AFB, OH USA

The Effect of Menstrual Phase and Oral Contraceptives on Female Adaptation and Performance at High G *Final Report, 22 Dec. 1995 - 31 Mar. 1997*

Chelette, Tamara, Armstrong Lab., USA; Mar. 1997; 40p; In English

Report No.(s): AD-A337400; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Females are now flying combat aircraft in the Air Force. Questions of gender differences regarding adaptation and performance in the high environment (9G) must be studied Scientifically. The Dynamic Environment Simulator, a three-axis centrifuge with closed-loop flight simulation, provides the laboratory to investigate the issues. Results. The eight women in this high-G performance study did not show cardiovascular adaptation to high whereas the eight men did. Both genders showed increased leg calf compliance indicating possible chronic vascular effects. No echocardiographic graphic evidence of heart damage was found The women demonstrated half the strength of the men, but displayed similar G tolerance and endurance. The women showed less oxygen desaturation of brain tissue than the men during high exposure. The women did not perform the simulated air-to-air combat

sortie quite as well as the men, though there was no effect of menstrual cycle on their ability to complete the mission There was no effect of high exposure on the length or the female monthly cycle, regardless of oral contraceptive use. Conclusion. Women demonstrated acceptable tolerance to and performance during simulated high aerial combat, without menstrual effect, even in light of their reduced muscular strength and cardiovascular adaptation as compared to men.
DTIC
Flight Training; Females; Cardiovascular System; Menstruation; Adaptation; Brain; Flight Simulation

19980045267 Bayview Research, Shalimar, FL USA
Current State of Army Aviator Selection *Final Report, Aug. 1996 - Feb. 1997*
Cross, Kenneth D., Bayview Research, USA; Aug. 1997; 83p; In English
Contract(s)/Grant(s): MDA903-93-C-0161
Report No.(s): AD-A336143; ASI/BR-105814-97-1; ARI-RN-97-22; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
 The current version of the Army's Flight Aptitude Selection Test (FAST) is aging and its predictive validity has declined substantially since it was first implemented. An analysis of existing records was performed to (a) determine the impact of the FAST's declining predictive validity on aviator trained eliminations and setbacks, and (b) estimate the benefits of increasing the FAST cut-score from its present value of 90. The analysis focused on the eliminations and setbacks that occurred during the period between January 1, 1989, and December 31, 1995. Detailed data are presented on (a) the annual number and costs of eliminations and setbacks, (b) the causes of eliminations and setbacks, and (c) the estimated consequences of increasing the FAST cut-score.
DTIC
Personnel Selection; Aircraft Pilots; Aptitude

19980047723
Assessing crew information requirements for advanced diagnostic and prognostic systems - Implications for interface and training design
Oser, Randall L., U.S. Navy, Naval Air Warfare Center, USA; Stout, Rene'e J., U.S. Navy, Naval Air Warfare Center, USA; Tyler, Robert, U.S. Navy, Naval Air Warfare Center, USA; 1997; In English; Copyright; Avail: Aeroplus Dispatch
 Advanced diagnostic technologies that track and fuse sensor observables have been used to provide improved information for helicopter maintenance purposes. Because these systems can provide detailed information about emerging system anomalies, such systems have recently been considered for use during in-flight operations. The current paper: describes the concept of aircrew information requirements, discusses a methodology that can be used to structure and guide investigations of aircrew information requirements, presents results from a test of the methodology using operational aircrews, and outlines the implications of the methodology for future interface and training design.
Author (AIAA)
Aircraft Maintenance; Helicopters; Multisensor Fusion; In-Flight Monitoring; Flight Crews

19980047724
Assuring human-centeredness in intelligent rotorcraft cockpits - Using crew intent estimation to coordinate RPA functions
Andes, Robert C., Jr., Applied Systems Intelligence, Inc., USA; 1997; In English
Contract(s)/Grant(s): DAAJ02-93-C-0008; Copyright; Avail: Aeroplus Dispatch
 The rationale and design for an intelligent Cockpit Intent Estimator (CIE) system for the Rotorcraft Pilot's Associate (RPA) is described. The CIE is an essential component of the RPA's crew-vehicle cockpit interface, known as the Cockpit Information Manager (CIM) function. Employment of the CIE in the associate allows the numerous, complex aiding functions of the RPA to remain 'lock-step' with the crew as the mission unfolds. CIE interpretation behavior, goal-processing activities, knowledge representation approach, and external communication mechanisms with other intelligent RPA subsystems are described with emphasis on CIE's essential role in the coordination of RPA functions to accurately follow the crew's lead and quickly regain coordination when the crew's intentions change. of particular interest is the RPA team's significant accomplishment in the area of combining prescriptive, automated task coordination with descriptive, intent understanding for producing intelligent associate behavior.
Author (AIAA)
Cockpits; Pilot Performance; Pilot Support Systems

Task-based interface management - A Rotorcraft Pilot's Associate example

Miller, Christopher A., Honeywell Technology Center, USA; Funk, Harry B., Honeywell Technology Center, USA; Hannen, Matthew, Boeing Helicopter Systems, USA; 1997; In English
Contract(s)/Grant(s): DAAJ02-93-C-0008; Copyright; Avail: Aeroplus Dispatch

Interface management (IM) involves sifting through a potentially overwhelming variety of incoming data, presentation options, control modes, and automation behaviors in order to present what the human operator(s) of a system currently need in a manner that will be easily understood and manipulated by them. In this paper, we discuss our work on an IM system for the U.S. Army's Rotorcraft Pilot's Associate (RPA) - a highly complex, flight-worthy associate system. Interface management functions, performed within RPA by the Cockpit Information Manager (CIM) can be summarized by five basic behaviors: symbol selection, page selection, window placement, pan and zoom setting, and task allocation. We describe each of these behaviors briefly, using examples from a sample RPA mission scenario, and present data from initial implementation and pilot evaluation studies pertaining to pilot acceptance of these interface management behaviors.
Author (AIAA)
Pilot Support Systems; Pilot Performance; Cockpits; Information Management

15
MATHEMATICAL AND COMPUTER SCIENCES

Includes mathematical and computer sciences (general); computer operations and hardware; computer programming and software; computer systems; cybernetics; numerical analysis; statistics and probability; systems analysis; and theoretical mathematics.

Naval Postgraduate School, Monterey, CA USA
Comparing the Maximum Likelihood Method and a Modified Moment Method to Fit a Weibull Distribution to Aircraft Engine Failure Time Data

Gueimil, Fernando, Naval Postgraduate School, USA; Sep. 1997; 103p; In English
Report No.(s): AD-A337364; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This thesis provides a comparison of the accuracies of two methods for fitting a Weibull distribution to a set of aircraft engines time between failure data. One method used is the Maximum Likelihood Method and assumes that these engine failure times are independent. The other method is a Modified Method of Moments procedure and uses the fact that if time to failure T has a Weibull distribution with scale parameter lambda and shape parameter beta, then T(beta) has an exponential distribution with scale parameter lambda(beta). The latter method makes no assumption about independent failure times. A comparison is made from times that are randomly generated with a program. The program generates times in a manner that resembles the way in which engine failures occur in the real world for an engine with three subsystems. These generated operating times between failures for the same engine are not statistically independent. This comparison was extended to real data. Although the two methods gave good fits, the Maximum Likelihood Method produced a better fit than the Modified Method of Moments. Explanations for this fact are analyzed and presented in the conclusions.
DTIC
Maximum Likelihood Estimates; Method of Moments; Weibull Density Functions; Aircraft Engines; Engine Failure

Computer Sciences Corp., Hampton, VA USA
The LVLASO I/O Concentrator Software Description, 3.5

Slominski, Christopher J., Computer Sciences Corp., USA; Plyler, Valerie E., Computer Sciences Corp., USA; Wolverton, David A., Computer Sciences Corp., USA; Jan. 1998; 35p; In English
Contract(s)/Grant(s): NAS1-20431; RTOP 522-14-31-02
Report No.(s): NASA/CR-1998-206907; NAS 1.26:206907; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper describes the software written for the VO Concentrator Unit in support of the Low Visibility Landing and Surface Operations (LVLASO) experiment flown on-board NASA's Boeing 757 aircraft.
Author
Boeing 757 Aircraft; Concentrators; Low Visibility; Applications Programs (Computers); Landing Aids

19980047465

Avionics integrity design methodology

Matonis, Richard A., TRW, Inc., Avionics Systems Div., USA; 1997; In English; Copyright; Avail: Aeroplus Dispatch

During the F22 CNI EMD Program, TRW developed a hardware development process that yields highly durable avionics. The avionics integrity process exposes and corrects design and manufacturing process deficiencies long before systems are delivered for field use. Early detection of design and manufacturing process flaws shortens the development cycle, while the improved hardware durability drives down cost of ownership. Implementation of this process will have a dramatic impact on the affordability of future helicopter avionics systems. This paper summarizes the approach and its high-level benefits, provides an illustrative case study from the F22 CNI EMD program, and explains how results have been leveraged to reduce development cost and technical risk on the Comanche ICNIA EOC program.

Author (AIAA)

Avionics; F-22 Aircraft; Aircraft Design; Vibration Measurement; Printed Circuits

19980047731

A structured approach to software interface development for the V-22 Osprey

Goldman, Steven, Boeing Helicopters, USA; Nicholson, Michael, Boeing Helicopters, USA; 1997; In English; Copyright; Avail: Aeroplus Dispatch

This paper describes the software interface design and control process that supported successful systems integration on the Bell-Boeing V-22 tiltrotor. The traditional interface control process utilizes an Interface Control Document (ICD) to define bit-level data that crosses the interface. The Bell-Boeing process augments traditional software interface control methods by also defining the software processing that supports the interface. V-22 interfaces that were developed using this technique have exhibited a low level of 'misunderstanding', which has translated into an equally low level of software rework.

Author (AIAA)

Software Development Tools; V-22 Aircraft; Cockpits; Systems Integration; Aircraft Control; Systems Engineering

19980048215

Software support for the automation of software product testing in aircraft industry *Matematicheskoe i programmnoe obespechenie avtomatizatsii ispytanij programmnykh izdelij v aviastroenii*

Moiseev, V. S., Kazanskij Gosudarstvennyj Tekhnicheskij Univ.-Kazanskij Aviatsionnyj Inst., Russia; Chuparina, M. A., Kazanskij Gosudarstvennyj Tekhnicheskij Univ.-Kazanskij Aviatsionnyj Inst., Russia; Aviatsionnaya Tekhnika; 1997; ISSN 0579-2975, no. 3, pp. 106-110; In Russian; Copyright; Avail: Aeroplus Dispatch

A system of mathematical models and methods is proposed as part of information technologies for the automation of software product testing in aircraft industry. The implementation of these models and methods in software is discussed. A program for calculating the bank in a trajectory control system for commercial aircraft is examined as an example.

AIAA

Commercial Aircraft; Software Development Tools; Flight Paths; Trajectory Control; Computer Programs; Support Systems

19980048299

Multi-sensor data fusion method to discern point targets

Li, Hong, National Univ. of Defense Technology, China; An, Wei, National Univ. of Defense Technology, China; Xu, Hui, National Univ. of Defense Technology, China; Sun, Zhongkang, National Univ. of Defense Technology, China; 1997, pp. 575-582; In English; Copyright; Avail: Aeroplus Dispatch

Two different vehicles which have the same shapes and sizes fly together in upper space at the same velocity. The vehicles are so far away from the sensors that the acquired images are point targets. No shape information can be determined. These two vehicles fly together and no motion characteristics may be used. Therefore their infrared (IR) radiation characteristics are important for discerning these two vehicles. In this paper, three ground-based IR sensors are used to get the IR radiation spectrum of the point targets, and twelve IR characteristics are selected for recognizing them. First, a BP network is used to recognize the point targets at each base. Then a Subjective Bayesian Method is adopted to fuse the recognized results given by BP networks on three bases at the same time. and the result given by Bayesian is fused by the Dempster-Shafer Evidence Theory with the result the next time till the belief function is more than threshold. The emulation shows that the last outputs are satisfactory.

Author (AIAA)

Multiple Target Tracking; Multisensor Fusion; Flight Vehicles; Multisensor Fusion; Infrared Imagery

Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy; optics; plasma physics; solid-state physics; and thermodynamics and statistical physics.

19980041462 Dayton Univ. Research Inst., OH USA

USAF Noisefile Database *Final Report, Apr. 1993 - Nov. 1996*

Mohlman, Henry T., Dayton Univ. Research Inst., USA; Feb. 1998; 74p; In English

Contract(s)/Grant(s): F41624-93-C-9000; AF Proj. 7757

Report No.(s): AD-A338072; UDR-TR-96-142; AL/OE-WP-TR-1998-0004; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

    This final report summarizes the effort performed to keep the Noisefile database updated with all current aircraft and helicopters. The new Noisefile 7 database format is documented with a detailed description of each record type. This Noisefile 7 database is used in all DoD noise modeling programs. The Noisefile 7 database contains flight and ground runup data for all Military aircraft and flight data for all available civil aircraft. Flight and Ground Runup summaries listings identity all aircraft and power conditions included in the database. Sample database records are presented for several aircraft.

DTIC

Data Bases; Aircraft Noise; Civil Aviation; Data Acquisition; Ground Tests

19980041697

Criterion for judging acoustic resonant vibration

Yan, Zhongsen; Tanaka, Hiroki; Matuzoe, Jungo; Tanaka, Kazuhiro; Nippon Kikai Gakkai Ronbunshu, B Hen/Transactions of the Japan Society of Mechanical Engineers, Part B; August, 1997; ISSN 0387-5016; Volume 63, no. 612, pp. 2719-2724; In Japanese; Copyright; Avail: Issuing Activity

    Acoustic resonant vibration occurs in a cavity with tube bundle when gas flow reaches a certain velocity. However, it does not always occur even though the condition that vortex shedding frequency coincides with acoustic natural frequency is satisfied. Fluid forces supply energy to acoustic resonant vibration and acoustic vibration consumes this energy to maintain vibration. Acoustic vibration does not occur if energy consumption is greater than energy supply and vice versa. The mechanism of the vibration was discussed in the previous paper and energy consumption was also presented in the paper. In this paper, judgment of vibration is made in terms of energy supply and consumption. Unsteady fluid dynamic force exerted on vibrating cylinders is measured instead of that produced in the flow with acoustic vibration. Energy supplies due to the fluid dynamic force are calculated and compared to the damping force. It was clarified that energy supply and consumption markedly depending upon the shape of cavity and portion of tube bundle.

Author (EI)

Resonant Vibration; Sound Waves; Vibration Mode; Aerodynamics; Damping; Fluid Dynamics; Cylindrical Bodies

19980044941

Thermovapor compression desalters: energy and availability - analysis of single- and multi-effect systems

Al-Najem, N. M., Kuwait Univ., Kuwait; Darwish, M. A.; Youssef, F. A.; Desalination; September, 1997; ISSN 0011-9164; Volume 110, no. 3, pp. 223-238; In English; Copyright; Avail: Issuing Activity

    Sidem (France) has made some recent advancements in thermal vapor compression (TVC) systems [1,2] by installing four units, each having four effects, 1 migd in capacity with a gain ratio of 8, and another four units of 12 effects each, with 2 migd capacity per unit and a gain ratio close to 17. This increased the interest in the system particularly for plants of low and medium capacity. The new system is characterized by the following: (1) the compression of most of the generated vapor and its usage as a heating medium drastically reduce the primary heat source (boiler) and heat sink (i.e., cooling water and condenser), as compared to conventional single-effect desalting systems; (2) low energy consumption; (3) simple water pretreatment as compared with reverse osmosis (RO) systems, which are the main competitors of mechanical and thermal vapor compression systems in small and medium capacities; (4) low capital and operating costs; and (5) recently developed reliable thermocompressors. Since very little is known about the principles and design of the system, a parametric analysis, using the first and second laws of thermodynamics, was conducted for the TVC system components, e.g., steam ejector, evaporator, condenser, as well as the system as a whole. The analysis pinpoints the deficiencies in the system and the methods of overcoming these deficiencies.

Author (EI)

Desalinization; Vaporizing; Vapors; Compressors; Boilers

Angle resolved mass spectrometry of positive ions transmitted through high aspect ratio channels in a radio frequency discharge

Stoffels, Eva, Kyoto Univ., Japan; Stoffels, Winfred Willem; Tachibana, Kunihide; Imai, Shinichi; Japanese Journal of Applied Physics, Part 1: Regular Papers & Short Notes & Review Papers; July, 1997; Volume 36, no. 7B, pp. 4632-4637; In English; 1997 3rd International Conference on Reactive Plasmas, ICRP, Jan. 21-24, 1997, Nara, Japan; Copyright; Avail: Issuing Activity

The behavior of positive ions in high aspect ratio structures, relevant to the reactive ion etching of deep trenches, has been studied by means of energy resolved mass spectrometry. High aspect ratio trenches are simulated by capillary plates with various aspect ratios. Angle resolved measurements of the ion current passing through the channels in the capillary plates have been performed in low pressure argon and helium radio frequency plasmas. The angular distribution of the ion counts becomes strongly anisotropic after the ions have passed through the channels. The narrowing of the ion distribution with increasing aspect ratio is explained by the loss of ions at the side walls of the channel. This loss is mainly a consequence of geometrical shadowing; ion loss due to deflection by surface charge on the capillary plates has only little effect at moderate power inputs. At high power inputs ion losses become extremely high, so the transmission through the channel plate decreases almost to zero.
Author (EI)

High Aspect Ratio; Mass Spectroscopy; Positive Ions; Radio Frequency Discharge; Beam Interactions; Plasma Interactions; Aspect Ratio; Electric Discharges; Argon

Supersonic radiative transport of electron-hole plasma in semiconductors at room temperature studied by laser ultrasonics

Gao, W., Katholieke Universiteit Leuven, Belgium; Gusev, V.; Glorieux, C.; Thoen, J.; Borghs, G.; Optics Communications; November 01, 1997; ISSN 0030-4018; Volume 143, no. 1-3, pp. 19-24; In English; Copyright; Avail: Issuing Activity

A piezoelectric semiconductor CdS(sub 1 - x)Se(sub x) crystal under external electric loading was excited by pulsed nanosecond ultraviolet laser radiation. Acoustic waves were excited via the inverse piezoelectric effect due to the screening of the external electric field by expanding the space distribution of photogenerated electrons and holes. The duration of the interferometrically detected longitudinal acoustic pulses indicated that both the expansion of the screened region in space and the electron-hole plasma expansion are supersonic at the time scale of laser action. The value of 2×10^3 cm^2/s obtained for the electron-hole plasma diffusivity leads to the conclusion that the mechanism of this fast carrier transport is photon recycling, i.e. reabsorption of recombination radiation. This conclusion is also supported by the acoustic signals duration independence on magnitude and polarity of the external electric field.
Author (EI)

Electron Plasma; Holes (Electron Deficiencies); Plasma Diffusion; Room Temperature; Semiconductor Plasmas; Semiconductors (Materials); Supersonic Transports; Acoustic Properties; Laser Beams; Cadmium Compounds; Electron Scattering

Laser Pencil Beam Based Techniques for Visualization and Analysis of Interfaces Between Media

Adamovsky, Grigory, NASA Lewis Research Center, USA; Giles, Sammie, Jr., Toledo Univ., USA; Feb. 1998; 10p; In English; 1998 Technical Conference, 22-26 Feb. 1998, Huntsville, AL, USA; Sponsored by NASA, USA
Contract(s)/Grant(s): RTOP 519-30-53
Report No.(s): NASA/TM-1998-206635; E-11099; NAS 1.15:206635; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Traditional optical methods that include interferometry, Schlieren, and shadowgraphy have been used successfully for visualization and evaluation of various media. Aerodynamics and hydrodynamics are major fields where these methods have been applied. However, these methods have such major drawbacks as a relatively low power density and suppression of the secondary order phenomena. A novel method introduced at NASA Lewis Research Center minimizes disadvantages of the 'classical' methods. The method involves a narrow pencil-like beam that penetrates a medium of interest. The paper describes the laser pencil beam flow visualization methods in detail. Various system configurations are presented. The paper also discusses interfaces between media in general terms and provides examples of interfaces.
Author

Flow Visualization; Aerodynamics; Hydrodynamics; Pencil Beams; Fluid Boundaries

XV-15 Low-Noise Terminal Area Operations Testing

Test procedures related to XV-15 noise tests conducted by NASA-Langley and Bell Helicopter Textron, Inc. are discussed. The tests. which took place during October and November 1995, near Waxahachie, Texas, documented the noise signature of the XV-15 tilt-rotor aircraft at a wide variety of flight conditions. The stated objectives were to: -provide a comprehensive acoustic database for NASA and U.S. Industry -validate noise prediction methodologies, and -develop and demonstrate low-noise flight profiles. The test consisted of two distinct phases. Phase 1 provided an acoustic database for validating analytical noise prediction techniques; Phase 2 directly measured noise contour information at a broad range of operating profiles, with emphasis on minimizing 'approach' noise. This report is limited to a documentation of the test procedures, flight conditions, microphone locations, meteorological conditions, and test personnel used in the test. The acoustic results are not included.
Author
XV-15 Aircraft; Tilt Rotor Aircraft; Low Noise; Noise Prediction (Aircraft); Aircraft Noise; Propeller Noise

Numerical study of the detached flow aerodynamical sound

A numerical study, based on the macrosimulation method, is carried out to determine the aerodynamic sound of a turbulent separated flow. The macrosimulation method uses a Large Eddy Simulation (LES) code to obtain the large structures of the flow, the small structures being modeled by a subgrid scale eddy viscosity. The radiated aerodynamic sound is obtained in the far field from the Lighthill-Curie formalism. The method permits one to dissociate the different sources of the aerodynamic sound: the wall noise due to the wall-pressure fluctuations, the shear noise due to the large scale quadrupole sources, and the turbulence self-noise generated by the small-scale quadrupole sources. The case of the normal backward-facing step is presented, and the different emitted noises are analyzed and compared to one another. Some theoretical hypotheses are tested.
Author (AIAA)
Computerized Simulation; Turbulent Flow; Separated Flow; Aerodynamic Noise; Large Eddy Simulation; Reynolds Stress

Effect of wake structure on blade-vortex interaction phenomena - Acoustic prediction and validation

The higher harmonic control aeroacoustic rotor test conducted at the Duits-Nederlandse Wind Tunnel has made extensive measurements of the rotor aerodynamics, far-field acoustics, wake geometry, and the blade motion for powered descent flight conditions. These measurements have been used to validate and improve the prediction of blade-vortex interaction (BVI) noise. The improvements made to the BVI modeling after the evaluation of the test data are discussed. The effect of these improvements on the acoustic-pressure predictions is shown. These improvements include restructuring the wake, modifying the core size, incorporating the measured blade motion into the calculations, and attempting to improve the dynamic blade response. A comparison of four different implementations of the Ffowcs Williams and Hawkings equation is presented. A common set of aerodynamic input has been used for this comparison.
Author (AIAA)
Blade-Vortex Interaction; Aeroacoustics; Rotor Aerodynamics; Noise Prediction (Aircraft); Sound Pressure; Aircraft Wakes

Prediction and measurement of blade-vortex interaction

An extensive quantity of airload measurements was obtained for a pressure-instrumented model of the BO-105 main rotor for a large number of higher harmonic control settings at Duits-Nederlandse Wind Tunnel. The wake geometry, vortex strength, and vortex core size were also measured through a laser light sheet technique and laser Doppler velocimetry. These results are

used to verify the blade-vortex interaction (BVI) airload prediction methodologies developed by Army Aeroflightdynamics Directorate, Deutsche Forschungsanstalt fur Luft-und Raumfahrt, NASA Langley Research Center, and the Office National d'Etudes et de Recherches Aerospatiales. The comparisons show that an accurate prediction of the blade motion and the wake geometry is the most important aspect of the BVI airload predictions.

Author (AIAA)

Blade-Vortex Interaction; Aerodynamic Loads; Noise Reduction; Noise Prediction (Aircraft); Helicopters; Rotor Aerodynamics

17
SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law, political science, and space policy; and urban technology and transportation.

19980048743

Cessna Aircraft reports record sales, deliveries

Phillips, Edward H., USA; Aviation Week & Space Technology; Feb. 16, 1998; ISSN 0005-2175; Volume 14, no. 7, pp. 49; In English; Copyright; Avail: Aeroplus Dispatch

In 1997, Cessna Aircraft Co. delivered an industry record 618 piston and turbine-powered airplanes. In 1998, it already faces a rising backlog already worth 2.8 billion dollars that reflect a growing demand for new aircraft. The rising demand for business aircraft, and particularly jets, resulted in a 35 percent increase in sales in 1997 compared with 1996. In the wake of a strong national economy and the surge in business flying activity, both in the U.S. and internationally, Cessna's financial and production performance in 1998 is expected to exceed that of 1997.

AIAA

Cessna Aircraft; Aircraft Production

19980048850

U.S. Army aircraft mass properties engineering

Donaldson, Neal J., U.S. Army, Aviation and Troop Command, USA; May 1997; In English

Report No.(s): SAWE Paper 2374; Copyright; Avail: Aeroplus Dispatch

The paper presents an analysis of the mass properties engineering process for U.S. Army aircraft. It includes a review of past practices. The impact of acquisition reform on the continuity of mass properties data is examined. Future directions for mass properties engineering are forecast.

Author (AIAA)

Military Aircraft; Mass Distribution; Aeronautical Engineering; Structural Weight

18
SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radation.

19980041523 Johns Hopkins Univ., Applied Physics Lab., Laurel, MD USA

Solar Vector Magnetic Field Research *Final Report, 1 Dec. 1993 - 30 Nov. 1996*

Rust, David M., Johns Hopkins Univ., USA; Feb. 14, 1997; 5p; In English

Contract(s)/Grant(s): F49620-94-I-0079

Report No.(s): AD-A337337; AFRL-SR-BL-TR-98-0172; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The principal effort was development and flight of the Flare Genesis Experiment (FGE). The FGE is a balloon borne solar telescope that can provide the sharpest view ever of the evolution of activity on the Sun. The goal of the FGE is to obtain the observations needed for a breakthrough in solar flare research both sooner and at significantly lower cost than either a satellite or adaptive optics can offer. The FGE flight was a historic first. This effort has shown that a meter class solar telescope can take advantage of the modern long duration ballooning program in Antarctica to achieve science goals that are central to solar activity research.

DTIC

Solar Magnetic Field; Flight Instruments; Solar Activity; Adaptive Optics; Telescopes

19980045161 NASA Langley Research Center, Hampton,VA USA

NASA Video Catalog, 1998, Supplement 3

Apr. 1998; 226p; In English

Report No.(s): NASA/SP-1998-7109/SUPPL03; NAS 1.21:7109(3); No Copyright; Avail: CASI; E99, Hardcopy; E99, Microfiche

  This catalog lists a wide variety of video cassettes available from the NASA STI Database. Subject matters that are covered include the following disciplines: Aeronautics, Astronautics, Chemistry and Materials, Engineering, Geoscience, Life Science, Mathematical and Computer Science, Physics, Social Science, and Space Science. The videos listed have been developed by the NASA centers, covering Shuttle mission press conferences; fly-bys of planets; aircraft design; testing and performance; environmental pollution; lunar and planetary exploration; and many other categories related to manned and unmanned space exploration. CASI

Catalogs (Publications); Space Transportation System Flights; Space Exploration; Geology; Geophysics; Environment Pollution; Aircraft Design

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Report Documentation Page

1. Report No. NASA/SP—1998-7037/SUPPL376	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Aeronautical Engineering A Continuing Bibliography (Supplement 376)		5. Report Date June 12, 1998
		6. Performing Organization Code
7. Author(s)		8. Performing Organization Report No.
		10. Work Unit No.
9. Performing Organization Name and Address NASA Scientific and Technical Information Program Office		
		11. Contract or Grant No.
12. Sponsoring Agency Name and Address National Aeronautics and Space Administration Langley Research Center Hampton, VA 23681		13. Type of Report and Period Covered Special Publication
		14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract

This report lists reports, articles and other documents recently announced in the NASA STI Database.

17. Key Words (Suggested by Author(s)) Aeronautical Engineering Aeronautics Bibliographies		18. Distribution Statement Unclassified – Unlimited Subject Category – 01	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 108	22. Price A06/HC